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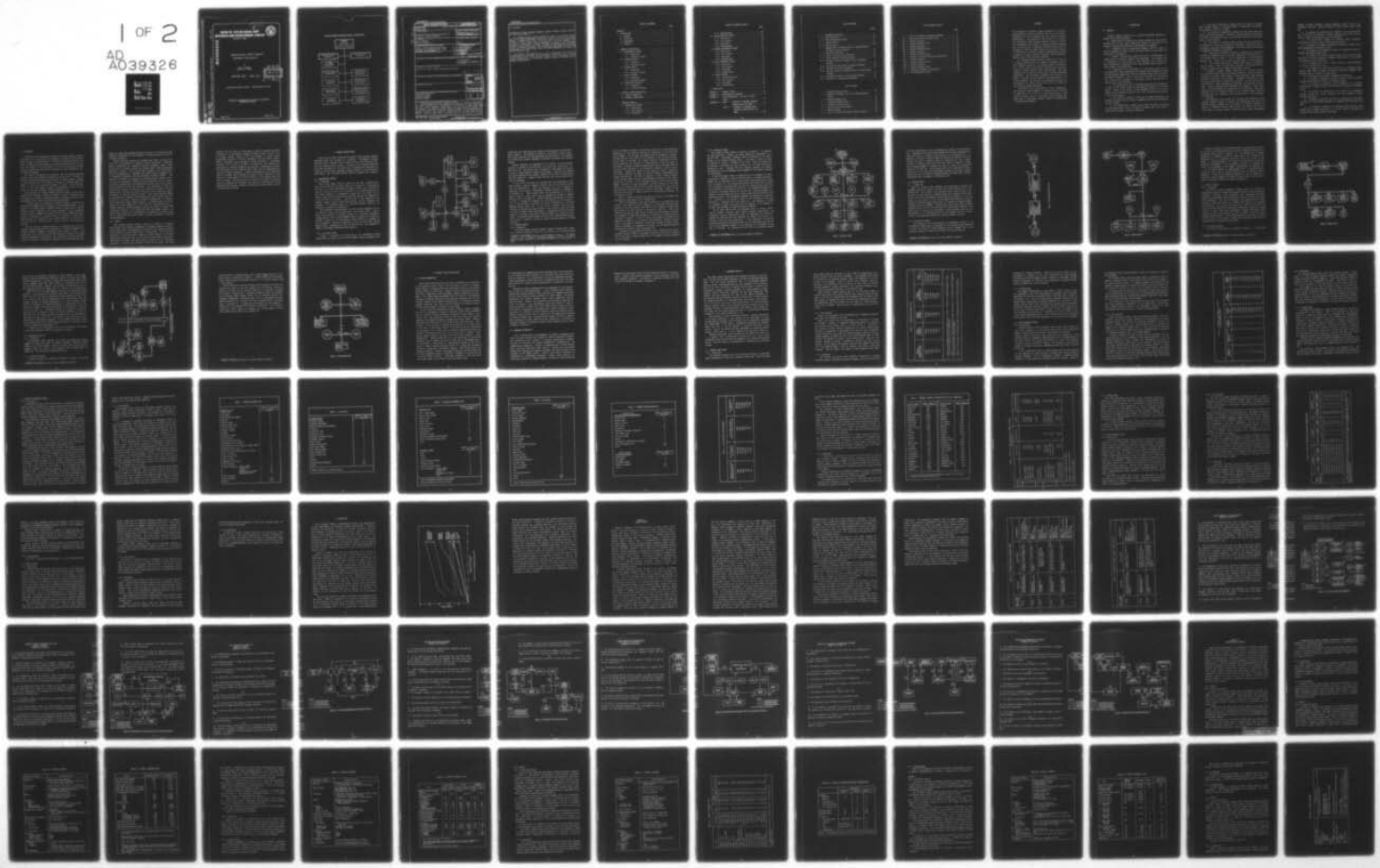

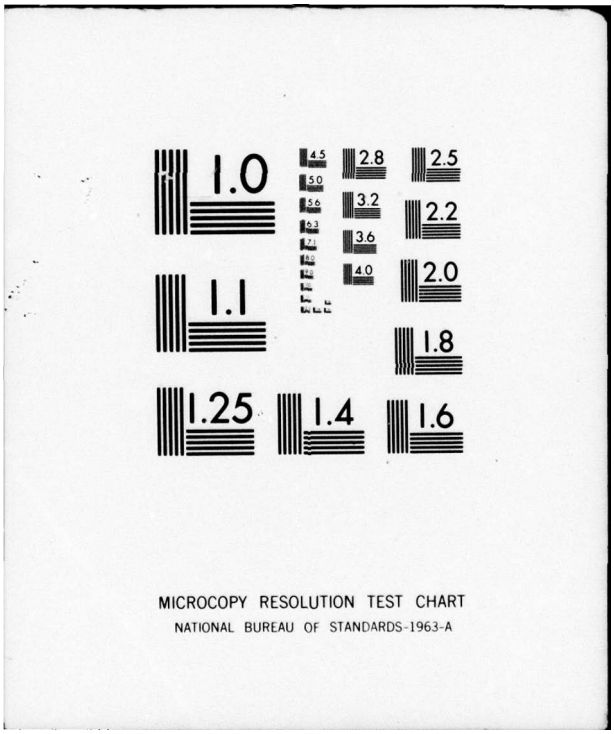
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DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER

Bethesda, Md. 20084

AUTOMATED PERSONAL PROPERTY OPERATIONS

PRELIMINARY SYSTEMS ANALYSIS

by

John L. Redding
Richard H. Serafin

CUT-OFF DATE - JUNE 1976

COMPUTATION MATHEMATICS AND LOGISTICS DEPARTMENT
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AUTOMATED PERSONAL PROPERTY OPERATIONS - PRELIMINARY SYSTEMS ANALYSIS

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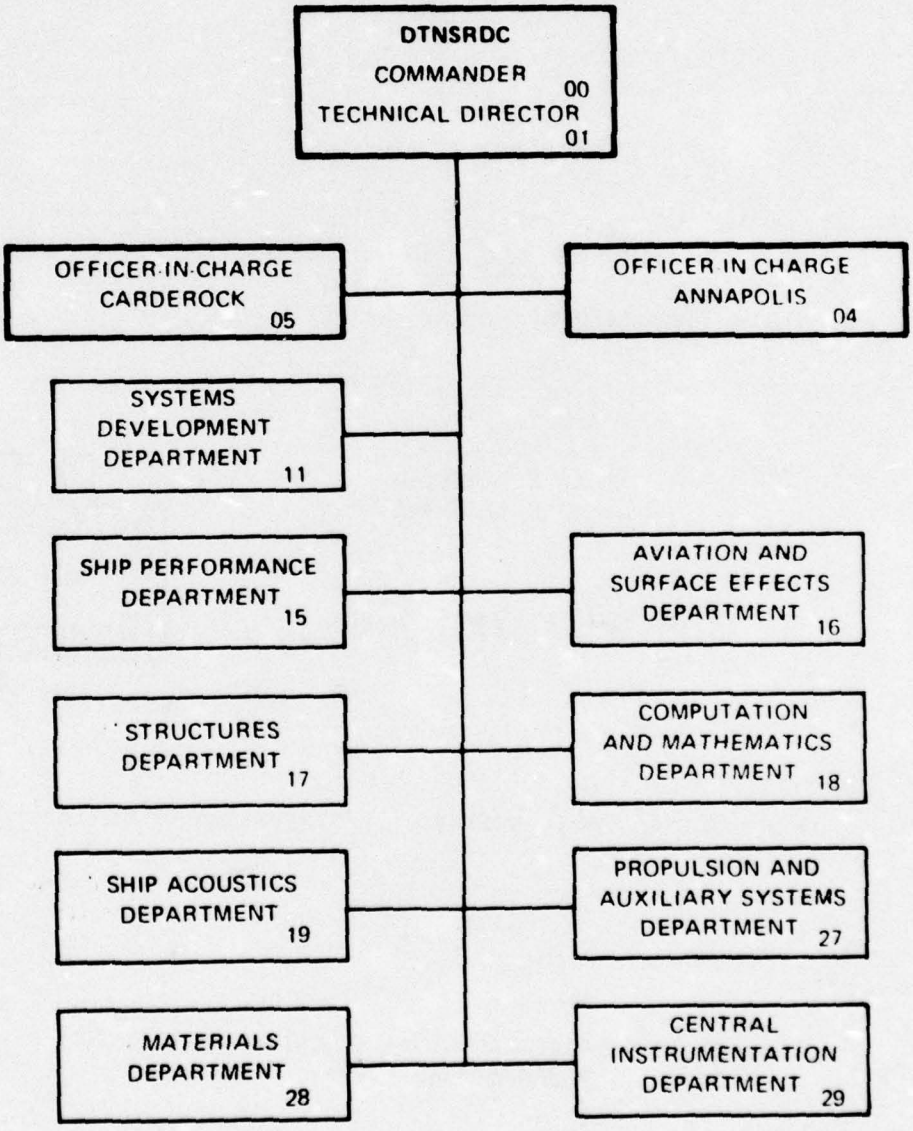

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The processing of personal property shipments is currently accomplished by manual procedures that are non-standard, cumbersome and time consuming, and that require extensive documentation. The objective of this project is to automate the procedures in Navy personal property offices to improve the coordination and control of personal property movement and, in particular, to improve visibility and quality of information used by these offices. The project focuses on those areas of personal property operations which involve

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nontemporary storage, outbound shipments, inbound shipments, quality control, and contractual services. This automated

The automated personal property system will consist of a computer network which ties together programmable intelligent terminals located at the personal property transportation offices (PPTO's) and large central processing units located at various remote service installations. The large computers will be used in a batch mode to provide management information. The intelligent terminals will be used in the PPTO's to provide for the completion and preparation of required documents, the selection of appropriate carriers, the interrogation of inbound status files, and the transmission and receipt of system information.

Since PPTO's vary significantly in size, requirements and resources, various degrees of automation may be required. A comparison of the costs for a batch-only system, a data key-entry system, and an intelligent terminal system indicates that an intelligent terminal system is cost-effective for medium-to-large PPTO's.

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ABSTRACT

The processing of personal property shipments is currently accomplished by manual procedures that are non-standard, cumbersome and time consuming, and that require extensive documentation. The objective of this project is to automate the procedures in Navy personal property offices to improve the coordination and control of personal property movement and, in particular, to improve visibility and quality of information used by these offices. The project focuses on those areas of personal property operations which involve nontemporary storage, outbound shipments, inbound shipments, quality control, and contractual services.

The automated personal property system will consist of a computer network which ties together programmable intelligent terminals located at the personal property transportation offices (PPTO's) and large central processing units located at various remote service installations. The large computers will be used in a batch mode to provide management information. The intelligent terminals will be used in the PPTO's to provide for the completion and preparation of required documents, the selection of appropriate carriers, the interrogation of inbound status files, and the transmission and receipt of system information.

Since PPTO's vary significantly in size, requirements, and resources, various degrees of automation may be required. A comparison of the costs for a batch-only system, a data key-entry system, and an intelligent terminal system indicates that an intelligent terminal system is cost-effective for medium-to-large PPTO's.

1 INTRODUCTION

1.1 PROBLEM

Personal property operations, as currently performed (Appendix A), present the following problems:

1. Applications for shipment and related documents are all prepared manually with, in many cases, significant amounts of time spent in the transfer of duplicative information from document to document.

2. Completed forms are distributed manually, which is costly in terms of manpower and postal rates, and which results in time delays and misrouting of information.

3. Shipment consolidations require the use of a "consolidated calendar" which is manually prepared and maintained. One calendar date is established for each carrier to each destination for a given date. Thus consolidation necessitates much cross-checking, paper manipulation, manual update, and computations.

4. Complicated cost comparisons for contractual services such as packing and crating, unpacking, local drayage, and nontemporary storage involve numerous computations which are performed manually and, therefore, are highly susceptible to error. Such errors can result in the selection of a non-low cost contractor for government service and therefore in higher costs to the government.

5. The inbound status file is maintained manually and is dependent, in part, on the timely receipt of documentation mailed by the outbound office. Delays in the receipt of such information result in the unnecessary use of storage-in-transit (SIT) and, therefore,in additional cost to the government.

6. The record of property in SIT must be manually maintained and reviewed to ensure that SIT costs are minimized, and that SIT entitlements are not exceeded.

7. The computation of carrier scores under the Carrier Evaluation and Reporting System (CERS) is manually performed which may result in errors and, therefore, in carrier complaints.

8. The manual scheduling of inspectors may not result in minimum time, minimum distance, or maximum number of inspections per workday. Thus inspection costs are increased.

9. The records of nontemporary storage lots and their expiration dates are maintained manually. Frequently, expired accounts which should be reviewed for appropriate action are overlooked, resulting in additional costs to the government.

10. The report of household goods storage and other reports must be prepared by collecting information from manual files which may be incomplete, inaccurate, and disorganized. Thus the accuracy and timeliness of management information is affected.

11. Invoices for nontemporary storage are prepared by the contractor, placing the responsibility for both data computation and verification on the personal property office. Lots in storage must be checked against manual files. Errors can increase storage costs to the government.

12. The tonnage distribution register (TDR) roster is maintained (usually using a slide file approach), accessed, and updated manually. It also is affected by any shipment consolidation actions.

In summary, personal property operations are seriously affected by the manual methods which are presently employed. Specific tasks are performed in a manner which tends to become cumbersome, time-consuming, ill-timed, inaccurate, and unreliable. Management information for monitoring system status, evaluating operations, and correcting system deficiencies is either disorganized, misleading, or practically nonexistent. Various operations and subsystems are segmented in ways which result in the ineffective and inefficient use of resources. These system problems result in lessened service to the military member (military personnel and their families), and increased costs to the government.

1.2 OBJECTIVE

The objective of this project is to automate the procedures in Navy personal property offices to improve the coordination and control of personal property movement and in particular to improve visibility and quality of information used by these offices. The project will focus on those areas of personal property operations which involve nontemporary

storage, outbound shipments, inbound shipments, quality control, and contractual services. Specific objectives within these various areas are:

1. To automate the generation and completion of all system forms and to facilitate the transfer of common information from form to form in order to reduce form preparation time and paperwork.

2. To electronically transmit all necessary system information from office to office to ensure timeliness and accuracy.

3. To automate the shipment consolidation process and thereby reduce paper manipulation and possible errors.

4. To automate the nontemporary storage cost comparison which will minimize government storage costs.

5. To automate the inbound shipment status file to permit on-line query for the effective response to shipment questions and the minimization of storage-in-transit (SIT) costs.

6. To automate the SIT file to ensure effective, timely management of SIT and to minimize SIT costs.

7. To automate the quantitative evaluation of household goods carriers under CERS and update the Traffic Distribution Register (TDR) quarterly basis as a result of these scores.

8. To facilitate the efficient scheduling of inspectors.

9. To automate nontemporary storage records to ensure accurate information and effective control over expired accounts.

10. To automate the generation and distribution of all relevant system reports to ensure accuracy and timeliness and facilitate management control.

11. To automate the preparation of all invoices for nontemporary storage, packing and crating, unpacking, and local drayage to ensure accuracy and control.

12. To update and maintain the TDR on an automated real time basis to ensure both the equitable assignment of tonnage and the accuracy of the TDR.

13. To integrate information and procedures across the five subsystem areas through exploitation of current computer technology and automation and systems analysis techniques.

1.3 BACKGROUND

The Navy has long recognized the need to automate personal property operations, and, in particular, the handling of accounts for the nontemporary storage of household goods. In 1970, the Naval Supply Center, San Diego, recognized the desirability of automating personal property operations and undertook the development of its own nontemporary storage computer programs; NSC, Norfolk also developed its own nontemporary storage computer programs.

The need for automating the procedures used for handling personal property accounts was likewise recognized by the Air Force. In 1966, the Air Force Data System Design Center started to develop computer programs to handle accounts for the nontemporary storage of household goods (NOTEMPS). In 1972, this system was available for export, and was implemented at 85 Air Force personal property transportation offices and more recently at two Joint Personal Property Shipping Offices.

The Naval Material Command (NAVMAT) and Naval Supply Systems Center (NAVSUP) have initiated a program at DTNSRDC to develop a logistics analysis capability through an integrated program of studies in material flow technology to meet current and evolving Navy requirements.

In January 1975 the automation of personal property operations was undertaken by DTNSRDC under the material flow technology program. At the request of the NAVSUP sponsor, DTNSRDC created a program plan to automate personal property operations with initial emphasis on the nontemporary storage problem. NOTEMPS was adapted for Navy use by DTNSRDC and implemented at Charleston on 1 January 1976 and at Oakland on 1 April 1976. Other modules to be automated in the eventual system are in the areas of outbound traffic, inbound traffic, quality control, and contractual services.

The Air Force Air Training Command, in conjunction with the Joint Personal Property Shipping Office, San Antonio, initiated development of a Personal Property Automated Information System (PPAIS) in 1974. This system came to the attention of the Deputy Assistant Secretary of Defense (Supply, Maintenance, and Service), who required that the Services form an ad hoc committee "to establish a program for the development and main-

tenance of common data systems specifications that can be used by all DOD components responsible for the management of personal property and household goods movements".

Various other Navy projects are underway which impact upon and integrate with the automation of personal property operations. SECNAVINST 5430.87 established the Integrated Financial Management System (IFMS) Project Office to design, develop, and implement major financial management improvement projects. One of the projects assigned to the IFMS Project Office for implementation (NAVCOMPT letter NCFP-25 dated 6 December 1974) is Integrated Disbursing and Accounting/Data Exchange (IDA/DX). One objective of IDA/DX is to establish a processing system in which transaction data are captured and entered into the system only once, with subsequent data transmission by telecommunications rather than by the creation and distribuiton of hard copy documents. The integration of APPO with IDA/DX should improve the accuracy and timeliness of personal property appropriation citations and should facilitate the billing and payment procedures for personal property services. Naval Supply Systems Command is sponsoring the Logistics Data Communication (LDC) project which may provide for the direct computer-to-computer communication of logistics data between Naval Supply Center computers. The APPO project will investigate use of this capability if it will exist at implementation time to transmit captured outbound personal property data from the origin PPTO intelligent terminal to the destination PPTO intelligent terminal via Supply Center computers for establishing or modifying a data base record for the destination office with timely, accurate information on expected inbound shipments.

1.4 CONCEPT

The automated personal property system will consist of a computer network which ties together programmable intelligent terminals located at the personal property transportation offices with large central processing units located at various remote service installations. If the system is developed on a Navy-only basis, computers located primarily at the Naval Supply Center would be used. If the system is multi-service (Air Force, Army, Marine, and Navy), the other Service computers will be utilized as necessary. In either case the basic concepts are the same. The large

computers will be used in a batch mode to perform automated accounting functions for the nontemporary storage of household goods (invoices, lots in storage, records, reports, etc.); the analysis of carrier tariff; quantitative evaluation of carrier performance; and the routing, consolidation, regrouping, and rerouting of system information. Intelligent terminals will be used in the PPTO's to provide for the completion and preparation of required documents, the selection of appropriate carriers, the interrogation of the inbound status files, and the transmission and receipt of system information. Selected information will be transmitted from the outbound office through the network (office terminal to large computer to large computer to office terminal) to the inbound office and back if desired. The execution of this concept will provide an automated system to integrate the information and procedures contained in the five subsystem areas (inbound, outbound, non-temporary storage, quality control, and contractual services).

2 GENERAL SYSTEM DESIGN

There are five major functional divisions within personal property operations which are suitable for automation: nontemporary storage; outbound traffic; inbound traffic; quality control; and contractual services for pack-and-crate contracts. Solutions to the problems associated with these divisions will be undertaken by analyzing the operations involved in each division, adopting a modular approach to the solution of each subset, and utilizing existing computer programs where possible.

2.1 NONTEMPORARY STORAGE

2.1.1 Background

When a Navy member receives orders for sea duty, overseas duty, duty in connection with building, conversion, fitting out, or reactivation of a ship, or in some cases permanent change of station, he is entitled to place or continue to store all or a portion of his household goods (up to his weight allowance) in nontemporary storage until new orders are received. Application for such service presently requires the completion of a DD Form 1299 by the member. A DD Form 1164 is then completed by the personal property officer authorizing packing, pick-up, drayage-in and storage of the household goods, or authorizing removal, delivery, and unpacking, as explained in Appendix A.

The nontemporary storage module for APPO provides management control of contractor costs, invoice preparation, and accounts status. After a survey was conducted of existing software for processing nontemporary storage acounts, the Air Force NOTEMPS computer programs were selected to provide a nucleus for the nontemporary storage module; the programs are well documented, continually maintained by the Air Force Data Systems Design Center, implemented at over 85 installations, and programmed in COBOL for Burroughs B3500/B3700/B4700 computers.

2.1.2 Conceptual Design

Figure 1 illustrates the interactions of the nontemporary storage module (which is based on the Air Force NOTEMPS computer programs) with a

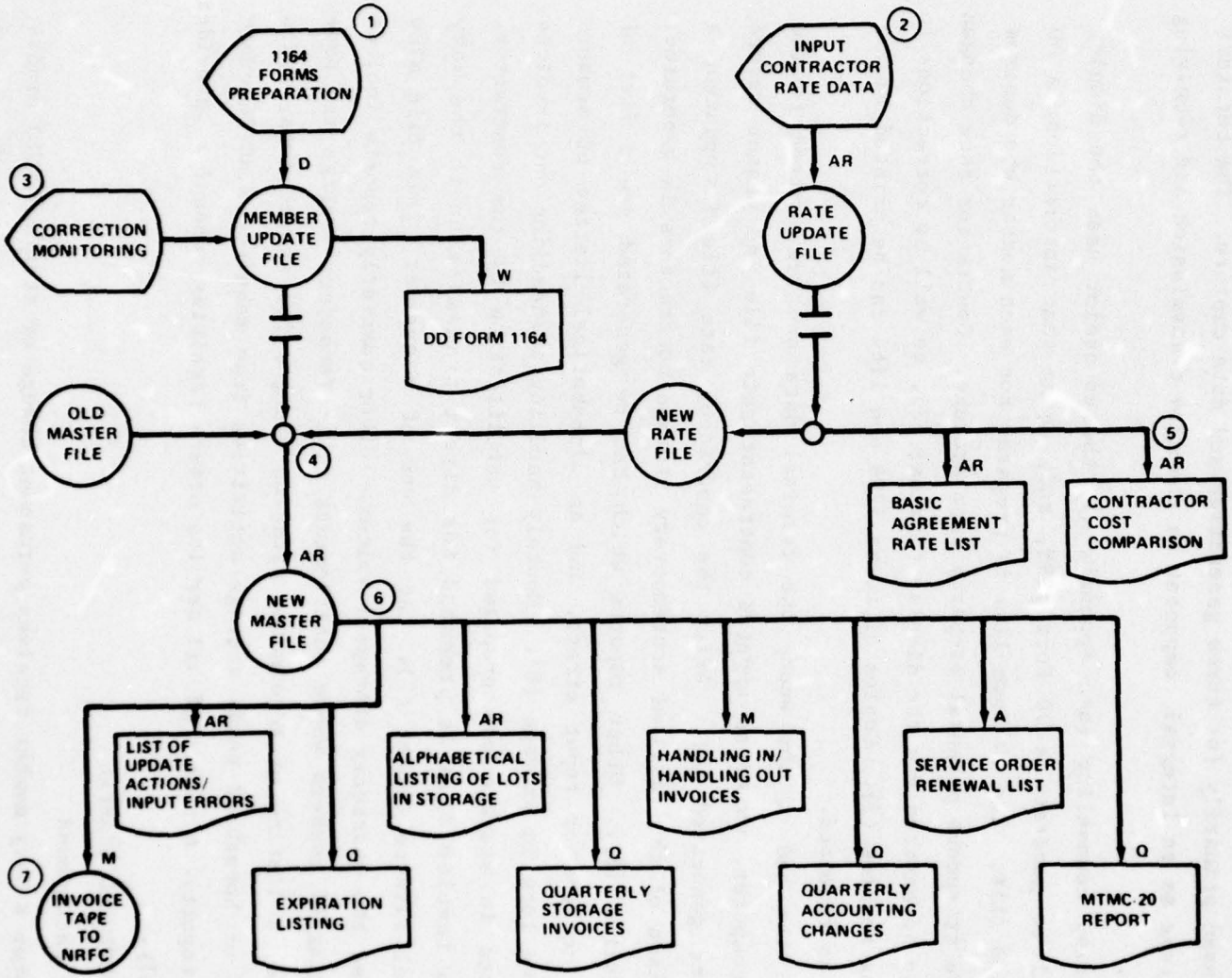

Figure 1 - Nontemporary Storage

Cathode Ray Tube (CRT) data entry system (an intelligent or quasi-intelligent terminal). The display is located in the personal property office and is used primarily for forms generation and data capture. The terminal also serves as an integral component in the data transmission and receiving network.

During counseling (see Appendix A), the counselor uses the display terminal to generate a DD Form 1299, and, using that information, a DD Form 1164 (1)*. The DD Form 1164 is prepared for each member who desires to store or remove personal property from storage. Contractor rate changes can also be entered via the display terminal (2), as well as corrections to existing records (3). Copies of forms 1299 and 1164 can be printed in the office as required.

At the end of the week, the terminal data are transmitted to the B3500 computer, where an updated contractor rate file and master record file are generated (4). After the contractor rate file is updated, a comparison of the rates of nontemporary storage contractors is generated, if required (5). Other reports which can be generated are a list of update actions or input errors, and an alphabetical listing of members who have lots in storage (6). Monthly handling in/handling out invoices for lots in storage are prepared for certification by the contractor, and an invoice file is prepared for direct transmission to the Navy Regional Finance Center (7). At the end of a quarter, this file also includes the quarterly storage invoices. Other quarterly reports include a listing of members whose entitlements to nontemporary storage may have expired, a listing of accounting citation changes for stored lots, and a report of household goods storage activities (the required MTMC-20 quarterly report). A report of all service orders requiring renewal is provided annually.

2.2 OUTBOUND TRAFFIC

2.2.1 Background

When a Navy member receives permanent change of station (PCS) orders, he is normally entitled to ship all or a portion of his household goods

* Numbers in parentheses refer to circled numbers on Figure 1. The abreviations D, W, M, Q, and AR, as defined in Appendix D, refer to the daily, weekly, monthly, quarterly, or as required creation of a form, report, or file.

(up to his weight allowance) to his new duty station or to other locations. Application for such service requires the completion of a DD Form 1299 by the member. At that time, the member tries to determine a realistic required delivery date (RDD) for his shipment at his new duty station. On the basis of the RDD, the Personal Property Transportation Office (PPTO) determines the best mode of transportation to meet the needs of the member. Normally in CONUS, household goods (HHG) are shipped directly from the origin residence to the destination residence in motor vans or containers. A member may request or veto a specific carrier. Otherwise, the carrier selection is based on possible shipment consolidation and tonnage distribution. The PPTO is required to offer tonnage equitably to all carriers within the same cost/performance category for each destination area (a state, a set of contiguous states, or other areas outside CONUS). Normally, for each destination, the PPTO ensures that the range between the carrier with the most tonnage assigned for the year and the carrier with the least does not exceed 20,000 pounds. However, if the PPTO can save money or improve service by consolidating shipments, he is expected to do so.

After a carrier is selected and agrees to accept the shipment, the PPTO prepares a government bill of lading (GBL).

Items of extraordinary value may be packed by a pack-and-crate contractor. Such items may then be shipped to a destination haul-and-unpack contractor, who then delivers the items to the residence, unpacks them, and verifies that they arrived in satisfactory condition. High value shipments also require a GBL and may accompany the HHG shipment; however, the consignee of high value shipments is normally the destination haul-and-unpack contractor. If for any reason the shipment is delayed at the origin by the member, or if receipt of the shipment is delayed at destination, the member is entitled to 90-180 days storage in-transit (SIT), which is chargeable in increments of 30 days. The SIT register should be monitored by the PPTO to avoid unnecessary SIT.

International moves generally require a GBL, a Transportation Control Movement Document (TCMD) if government shipping facilities are involved, and a motor vehicle shipment application if a member's private automobile is to be shipped.

2.2.2 Conceptual Design

The outbound traffic module is depicted in Figure 2. It presents the data collection, storage, and report generation requirements of a typical PPTO. Intelligent terminals would be available to the interviewers in the Personal Property Office. No attempt is made to include an analysis of tariffs or tenders at this time. (Such an analysis may be required to determine low cost carriers, but the extent required is undefined as yet). Existing Air Force computer programs can probably be modified for use in designing certain segments of the computer programs for this module.

At the interviewer's desk, an application for the shipment of household goods is completed by using a DD Form 1299 or a suitable substitute. Member veto or preference for a carrier and/or pick-up date may be keyed in as an option (1).* The tonnage distribution file (refer also to Section 2.4) is queried to determine both the next low tonnage carrier and/or the roster position of the requested carrier (2). The scheduled shipment file is queried to determine whether any carrier has a previous shipment consigned to the same destination with a pick-up date within three days of the requested pick-up. Thus preliminary shipment consolidations are possible (3). Selection of the carrier is made at the interviewer's desk and verified by a telephone call to the carrier (4). The acceptance or refusal of a shipment is keyed in and both files are updated. If the shipment is refused, the procedures outlined above may be repeated.

The DD Form 1299 as well as government bills of lading, traffic control movement documents, motor vehicle shipment applications, and accessorial service authorization forms are generated and printed to provide the required hard copy documents for members and carriers (5). Pertinent data are then transmitted. A tape listing of contractors providing hauling and unpacking service at the destination area will be used by the mainframe computer in the selection of a consignee for the GBL, if required. An outbound data file will be continually updated

* Numbers in parentheses refer to circled numbers on Figure 2.

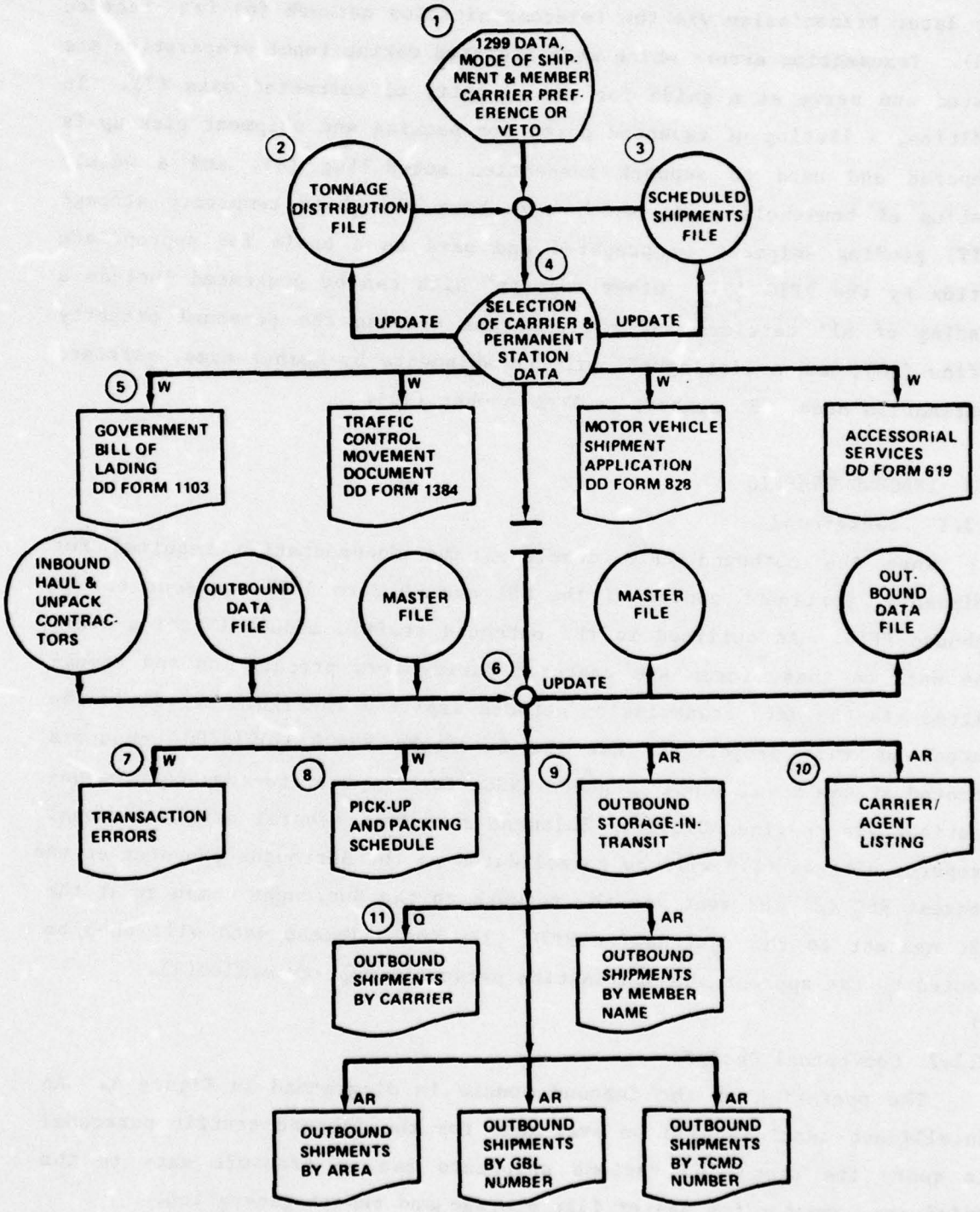

Figure 2 - Outbound Traffic

for later transmission via the telecommunication network (6) (see Section 2.3). Transaction errors which were accepted during input preparation are listed and serve as a guide for the re-entry of corrected data (7). In addition, a listing of expected dates for packing and shipment pick-up is prepared and used to support inspection scheduling (8), and a weekly listing of household goods which have been placed in temporary storage (SIT) pending shipment is prepared and used as a basis for appropriate action by the PPTO (9). Other reports which can be generated include a listing of all carriers and their agents serving the personal property office (10), and a listing of outbound shipments by member name, carrier, destination area, GBL number, or TCMD number (11).

2.3 INBOUND TRAFFIC

2.3.1 Background

When the outbound PPTO completes the documentation required for shipments, pertinent copies of the GBL and DD Form 1299 are sent to the inbound PPTO. As outlined in the outbound traffic module (Section 2.2), the data on these forms are captured during form preparation and transmitted via the data transmission network depicted in Figure 3. It is the intent of this project to use the Burroughs B3500/3700/4700 computers located at the Naval Supply Centers (NSC) for computer-to-computer communications via on-line AUTODIN. Shipment data from several origin personal property offices (1)* will be consolidated on the Burroughs computer at the nearest NSC (2) and sent via the network to the Burroughs computer at the NSC nearest to the destination PPTO (3); the shipment data will then be routed to the appropriate destination personal property office(4).

2.3.2 Conceptual Design

The operation of the inbound module is diagrammed in Figure 4. An intelligent terminal will be available for the inbound traffic personnel to query the status of various shipments and to transmit data to the mainframe computer for master file storage and report generation.

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* Numbers in parentheses refer to circled numbers on Figure 3.

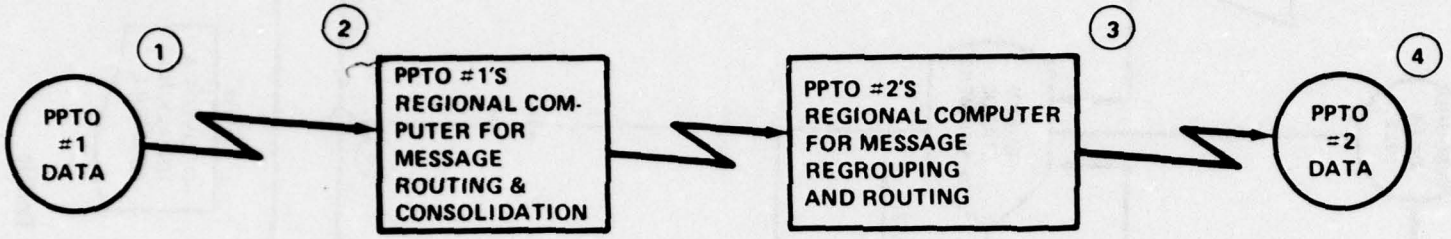


Figure 3 - Data Transmission Network

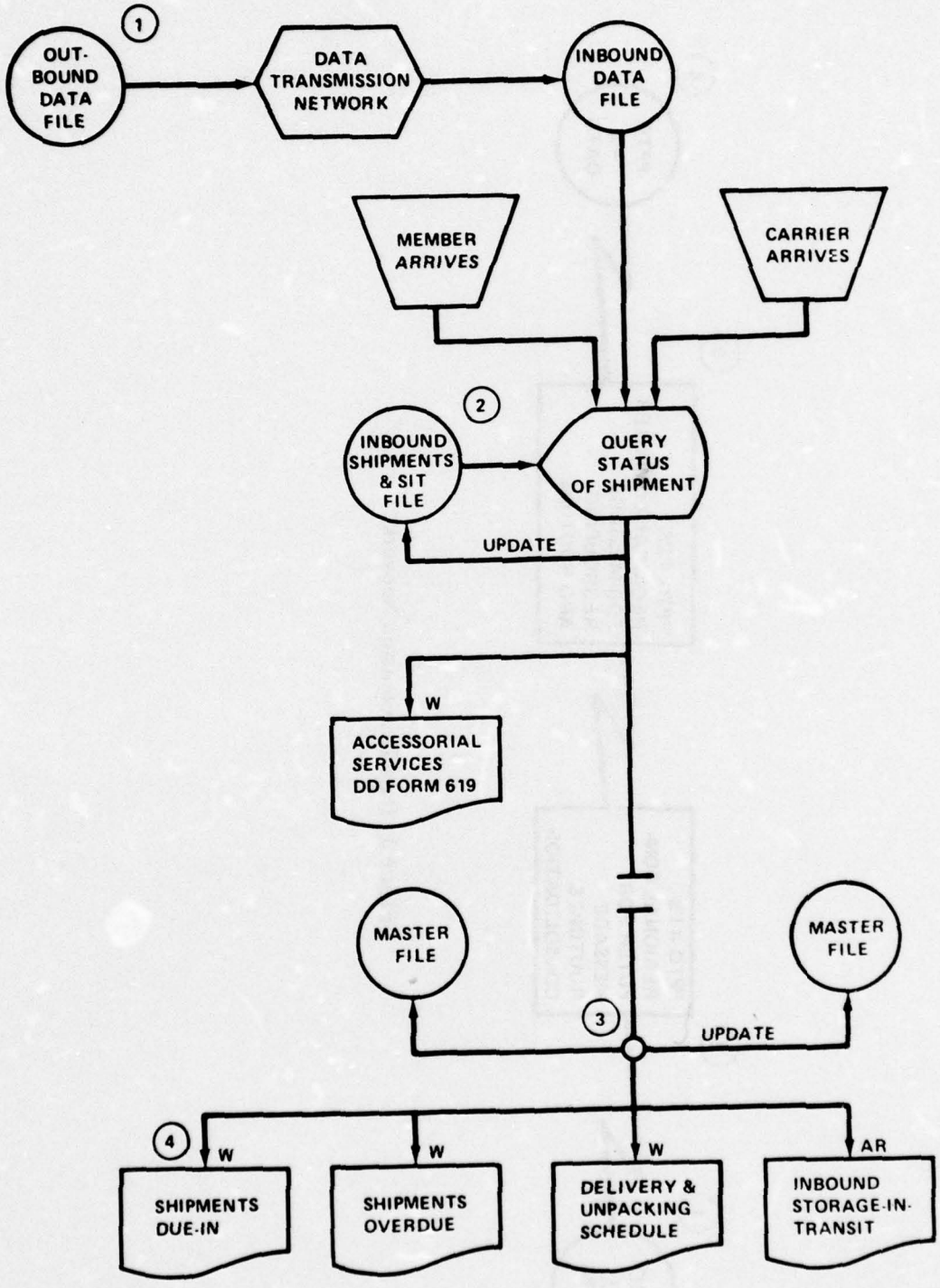


Figure 4 - Inbound Traffic

As shown in Figure 4, the outbound traffic file discussed in Section 2.2 is sent to the inbound PPTO via the data transmission network on an as-required basis (daily or weekly) (1).* An inbound file is either constructed or updated by receipt of these data or by the arrival and subsequent entry of information provided by either the carrier or the member. If either the member or the carrier arrives and the file has been previously established, it can be updated or queried to determine the status of the shipment or the member's availability for delivery (2).

At the B3500 computer, an inbound master file is continually maintained (3) and is used to provide reports such as a listing of due-in shipments, a delivery and unpacking schedule for use by inspectors, a listing of overdue shipments for possible tracing, and a listing of shipments in temporary storage for accounts monitoring (4).

2.4 QUALITY CONTROL

2.4.1 Background

The Military Traffic Management Command (MTMC) has initiated an experimental method for establishing personal property carrier performance standards, collecting carrier performance data, measuring performance against those standards, and distributing traffic on the basis of historical performance. The Carrier Evaluation and Reporting System (CERS) provides a quantitative basis for evaluating the quality of a household goods shipment. The intent of the system is to reward those carriers who provide the best service with additional tonnage while concurrently denying traffic to those firms which demonstrate, through consistently lower evaluation scores, the inability or lack of desire to provide quality personal property moves. If the CERS experiment is successful, the quantitative means of distributing tonnage and evaluating carriers will be incorporated in the quality control module.

2.4.2 Conceptual Design

The quality control module is depicted in Figure 5. It also makes

* Numbers in parentheses refer to circled numbers on Figure 4.

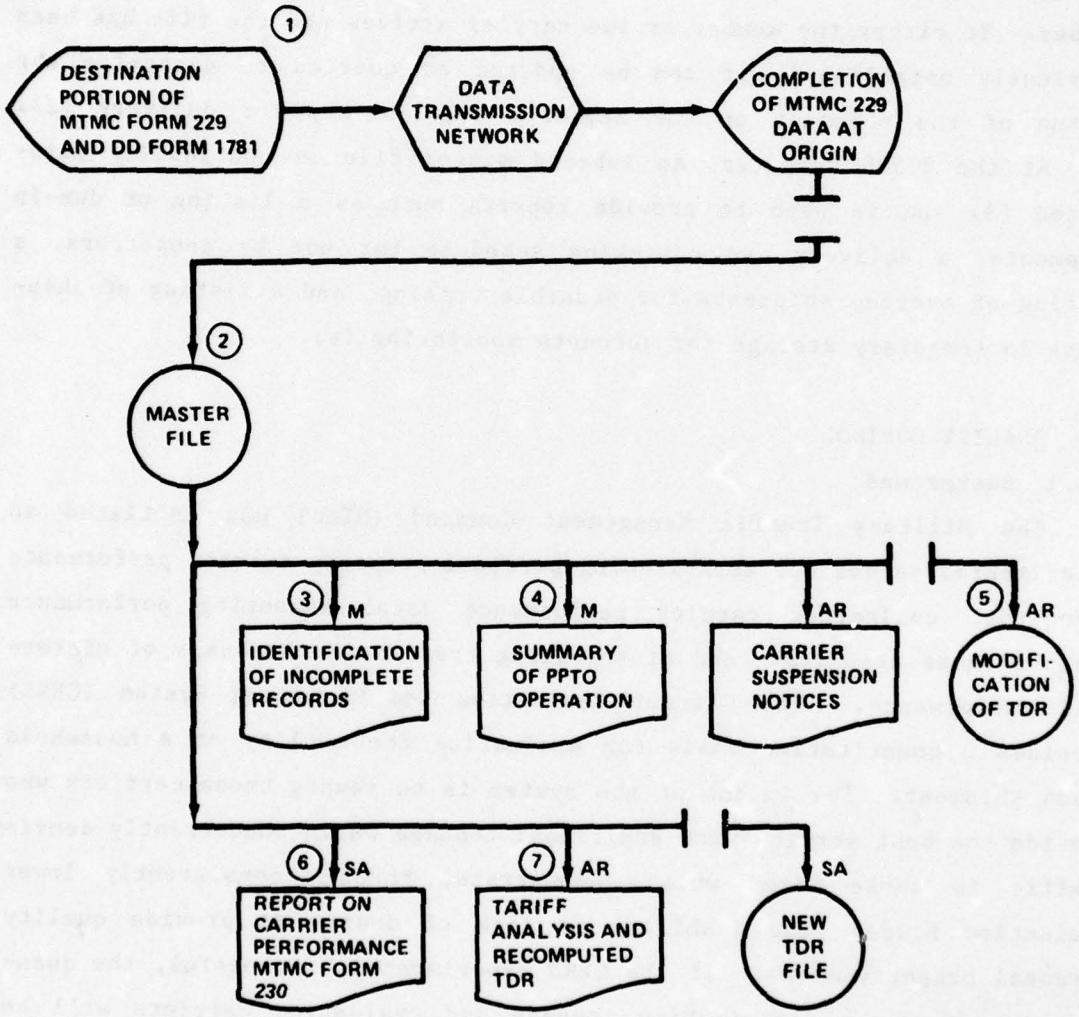


Figure 5 - Quality Control

use of both an intelligent terminal for forms completion, data transmission, and data storage and a mainframe computer for master file storage and report generation. Listings of pickup and delivery dates, which can be used to schedule inspections, might normally be considered a part of the quality control module. However, such listings are generated as part of the outbound and inbound modules and are therefore not included here.

MTMC Form 229 is the CERS Shipment Evaluation and Inspection Record document. It incorporates data from the origin PPTO, from the destination PPTO, and from the Customer Satisfaction Report (Revised DD Form 1781) (1).* Data on each move are maintained on the B3500 master file, and shipment records are purged semiannually (2). Those shipment records which are incomplete are identified monthly for appropriate action (3). Each month a summary of statistics pertaining to the operation of the PPTO will be provided (4). Suspension notices are generated as required. The TDR is to be modified to take into account suspended carriers (5). MTMC Form 230, the carrier evaluation worksheet/report, are generated for each move for each carrier (6). An analysis of new tariffs and carrier performance is performed as required. A new tonnage distribution roster file is generated from the tariff analysis and from the evaluation of the carrier's performance semi-annually (7).

A summary of the interactions of the last three modules with respect to the data transmission network is presented in Figure 6.

2.5 CONTRACTUAL SERVICES

2.5.1 Background

Pack-and-crate (P&C) contracts are written for packing and crating baggage and high value items for outbound shipments, unpacking inbound shipments, and local drayage. There is no upper limit on the amount of baggage allowed; the limit is on the types of items allowed, which are predefined. P&C contracts are negotiated locally.

2.5.2 Conceptual Design

Computer programs are required to generate an Order for Services

* Numbers in parentheses refer to circled numbers on Figure 5.

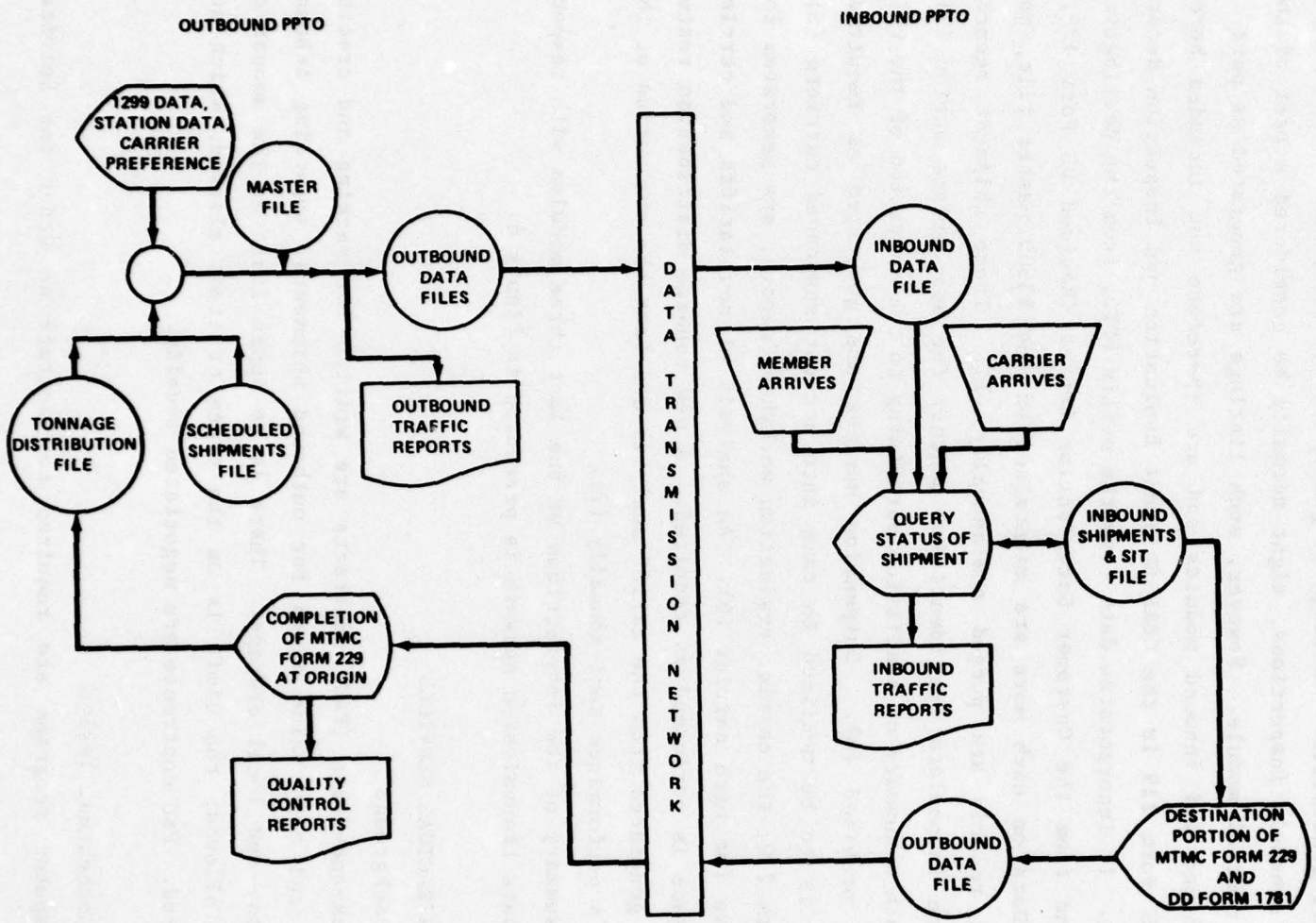
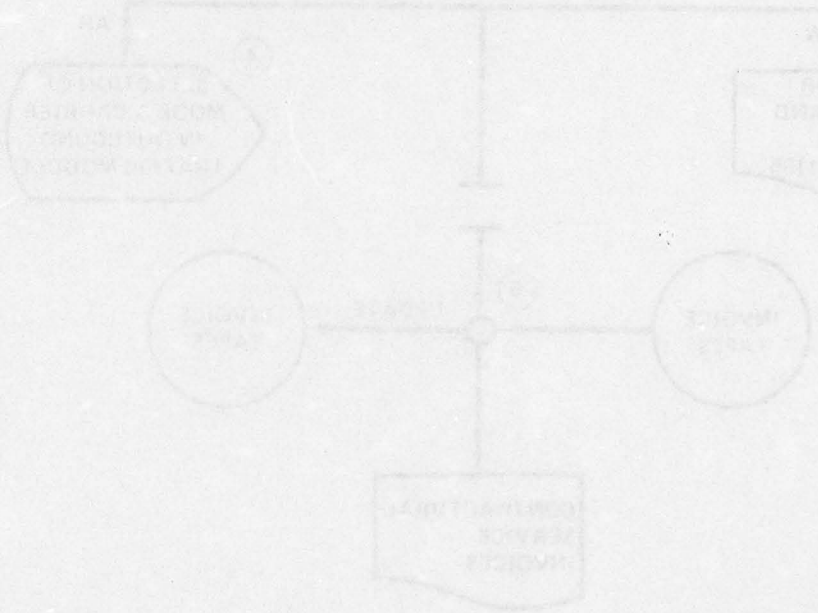


Figure 6 - Summary Flow of Outbound Traffic, Inbound Traffic, And Quality Control Modules

(DD Form 1155), to handle billing, and to handle baggage as part of outbound traffic, as depicted in Figure 7. These programs will be executed either locally using an intelligent terminal or at a central location using a large computer.

DD Form 1299 data is entered through the CRT during the interview and captured and stored on the local system; the pack-and-crate contractor selection (if there is more than one contractor) is performed if packing and crating is required (1)*. Pertinent information about the pack-and-crate contractor (name, address, rates, etc.) is retrieved from the file. Consignee information is selected from a file of destination haul-and-unpack contractors (2). DD Form 1155 can be produced locally on a weekly basis if required (3). If packed and crated goods are to be shipped on a separate GBL, the outbound traffic module is entered (4). At the B3500, a contractual service invoice is produced, and the Navy Regional Finance Office (NRFC) invoice data file is updated (5).



* Numbers in parentheses refer to circled numbers on Figure 7.

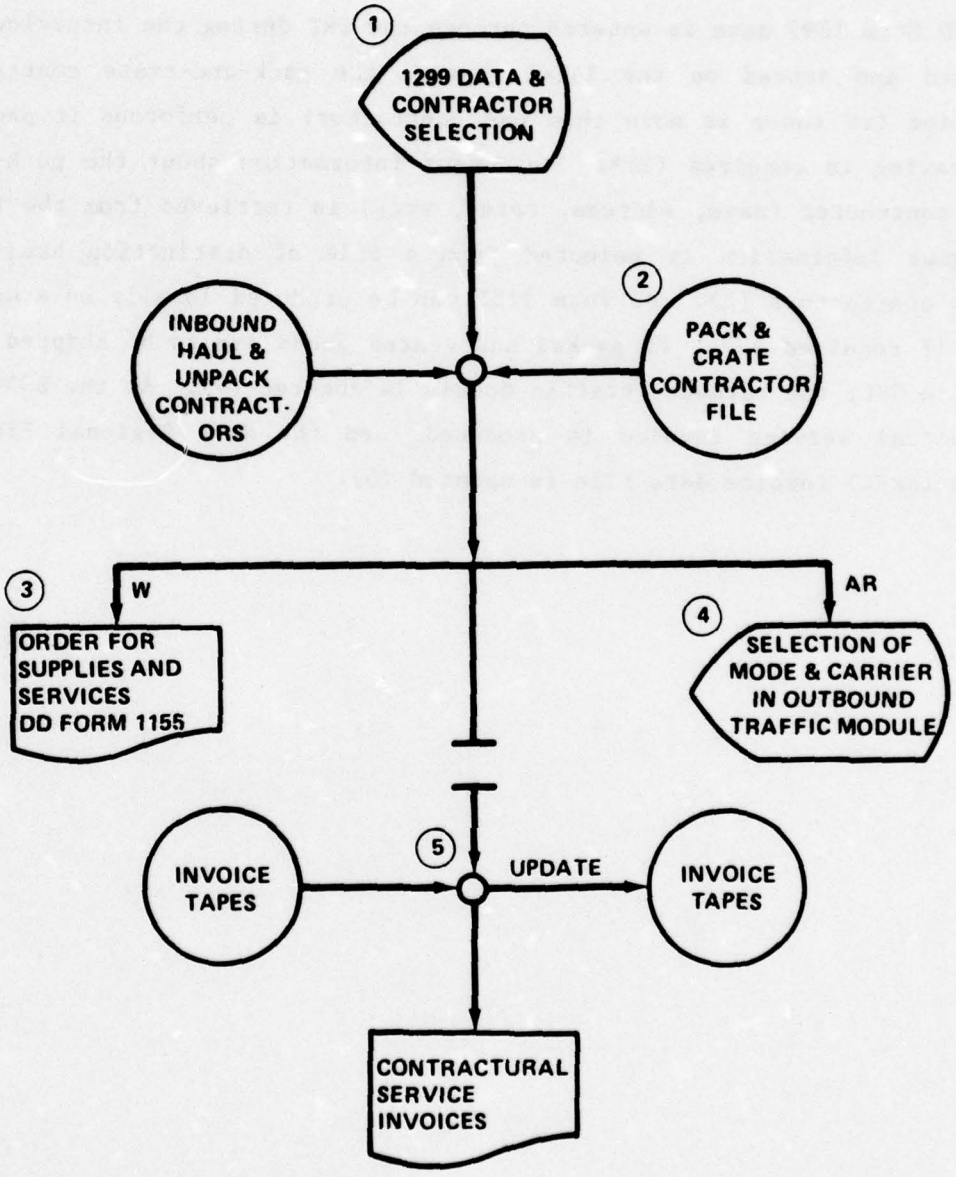


Figure 7 - Contractual Services

3 OPTIONAL SYSTEM DESCRIPTIONS

3.1 SYSTEM ALTERNATIVES

Many system alternatives were initially considered for the operation of the personal property office, from continuing to operate the present manual system to providing sufficient minicomputer power in the personal property offices to allow them to operate as self-contained data processing centers (assuming no other government computer capability was available). In a letter dated 10 November 1975, the Office of the Assistant Secretary of Defense (Installation and Logistics) requested that the four services develop joint computer specifications for automating personal property operations. This study therefore assumed that personal property offices will be required to automate to some degree.

The Air Force has implemented personal property computer programs, such as the non-temporary storage of household goods accounts (*NOTEMPS*) and the Personal Property Automated Information System (PPAIS), which utilize input data keypunched directly from forms which are manually prepared in the Personal Property Transportation Office (PPTO). However, some small Navy PPTO's may not have ready access to ADP facilities. Their options, if they continue to complete forms manually, are to mail copies of the forms or data sheets directly to an ADP facility for keypunching and processing, or to utilize local contractual keypunching services and transmit the resultant data cards to an NSC by mail or AUTODIN. These manual methods, however, preclude any on-line error checking or query capabilities. Another possibility is to use key-to-tape or key-to-disk equipment, and to transmit the data by either mail or telecommunications. An alternative to these manual or semi-automated methods is the use of either a "dumb" terminal connected on-line to a larger data processing system or a stand-alone "intelligent" terminal. Both allow on-line error checks and queries. However, the present workload on the NSC B3500's and the line transmission costs (as discussed in Appendix C) preclude the use of on-line "dumb" terminals. Intelligent terminals, on the other hand, can be used either in real time at each interviewer's desk

for forms generation completion and error checking, they can be used alone or in "clusters" as batch processors for forms generation, data collection, and error checking. All collected data can then be transmitted for additional processing to an ADP facility by telecommunications later. The hardware analysis for various system configurations is presented in the next section.

Alternative network configurations were considered for the transmission of data via telecommunications. A fully automated (self-contained, stand-alone) personal property office could serve as a message concentrator for all other personal property offices in a given region. As another possibility, all personal property offices could communicate directly with each other. However, this alternative would require a great deal of effort and expense, since approximately 1200 links (direct or dial-up) would be required to connect the 49 Navy CONUS personal property offices. Since NAVSUP is developing a telecommunications network linking the computing power of the B3500's, and since regional connections between personal property offices and NSC's will be required for the computerized processing of personal property data, linking personal property offices to regional NSC's represents the least expensive and most logical way to facilitate the automated exchange of information between personal property offices (refer to Figure 3, Section 2).

3.2 HARDWARE ALTERNATIVES

Over 75 manufacturers of programmable calculators, intelligent terminals, and dumb terminals were surveyed to identify applicable hardware. Five manufactures were selected as offering representative hardware. Criteria for selection were system expandability, programmability, and communications capability. System A is representative of those programmable calculators which meet these criteria. System B was investigated because that manufacture's hardware previously had been procured and was available at the Supply Centers. System C and System D represent the capabilities of "intelligent" terminals. System C meets selection criteria best; System D is a system on-hand at the David W. Taylor Naval Ship

Research and Development Center and was considered because of its availability. System E dumb terminals represent the most economical video display terminals available. An analysis of applicable hardware for each of the five systems is presented in Appendix B.

4 HARDWARE ANALYSIS

Five major system alternatives are evaluated in detail in this section. All five use the B3500 computers at the NSC for mainframe computing power. The five system alternatives are: (1) non-automated personal property offices, using keypunching for input preparation (as is presently done at Air Force facilities in Norfolk and San Diego to utilize their nontemporary storage processing programs); (2) quasi-automated personal property offices using dumb terminals only for forms generation, data capture, and data preparation for input to NSC computer programs; (3) partially-automated personal property offices with a limited number of terminals available for forms generation, data capture, input preparation, file query, and local report generations; (4) fully-automated personal property offices, with clustered terminals available for all HHG personnel involved in forms generations, data capture, input preparation, file query, and local report generation; and (5) a hybrid system combining alternative 2 with either alternative 3 or 4.

The discussion of each alternative includes a detailed description of the system alternative, a cost analysis for the procurement or rental of representative hardware, and a discussion of the supplemental advantages and disadvantages of that system. Supplemental advantages and disadvantages refer only to the five degrees of automation described in this section. They do not address the many advantages of automating personal property offices per se. A cost comparison is presented in Section 5.

Hardware procurement costs are based on the quoted 1975 GSA price. It is possible that a manufacturer's system price for a major system procurement would be lower than the summation of his advertised component prices. This was taken into consideration in evaluating the alternative systems.

4.1 PUNCHED CARD SYSTEM

4.1.1 Description

The personal property office would continue the manual or semi-automated preparation of forms as is presently being done. Data from these

forms would either be transcribed to data forms for keypunching or key punched directly from the source documents. The keypunched data would be verified by the personal property office and submitted to the ADP facility for processing. Since no on-line query capability would be available, the organization and the status of such files as expected incoming shipments, tonnage distribution, and scheduled shipments, would be created and maintained manually, as is presently done.

Those personal property offices which do not have ready access to a B3500 could retain their manual systems, mail copies of their raw data forms to the NSC for keypunching and processing (with no initial user data checks), or keypunch and verify their own data using locally contracted keypunching, and then transmit the data cards to a B3500 system by either mail or AUTODIN. Reports would be transmitted back to the office by mail.

4.1.2 Cost Analysis

There is no procurement cost for hardware with a punched card system, since there is no hardware to procure.

There is no direct cost for keypunching if keypunching is provided by the NSC's. However, if commercial keypunching service is required, such service can be quite costly, as shown in Table 1. Analysis of the existing Air Force computer programs and the overall system design indicates a requirement of approximately one card for each nontemporary storage transaction, five cards per outbound shipment, and four cards per inbound shipment. An additional 10% of the initial minimum number of cards required is allowed for errors, record modifications, contractor rate changes, storage in transit, disqualified carriers, or other special actions. As an example, GSA keypunch contracts with DTNSRDC quote rates of $7 per hundred cards or $40 per thousand cards (with a guaranteed minimum). Data for Table 1 were based on these assumptions and rates.

4.1.3 Advantages

The punched card system allows immediate utilization of existing personal property automated information systems, such as the Air Force

TABLE 1 - ESTIMATED KEYPUNCH COSTS

ANNUAL NONTEMPORARY STORAGE ACTIONS[1]	ANNUAL OUTBOUND SHIPMENTS	ANNUAL INBOUND SHIPMENTS	TOTAL KEYPUNCHED CARDS REQUIRED[2]	ANNUAL COST ($)[3]
8,000	20,000	20,000	206,8000	8270-14,480
3,200	8,000	8,000	82,720	3310-5790
1,600	4,000	4,000	41,360	1650-2900
800	2,000	2,000	20,680	830-1450
400	1,000	1,000	10,340	410-720
200	500	500	5,170	210-360

1. Based on 1 nontemporary storage application for every 5 inbound or outbound shipments (ratios from Norfolk personal property operations).

2. Based on 1.1 cards for every nontemporary storage application, 5.5 cards per outbound shipment, and 4.4 cards for every inbound shipment.

3. Based on a cost range of $7/hundred cards to $40/thousand cards for verified keypunching.

nontemporary storage programs. There is no initial outlay for the procurement of hardware, nor are there time-delays and other problems associated with the procurement process. Finally, no intelligent terminal software development is required for non-automation, although mainframe computer programs will still be required.

4.1.4 Disadvantages

The biggest disadvantage to this system is that it does not take full advantage of the cost effectiveness of automated data processing. Preparation of data must go through several iterations prior to input to the computer (i.e., initial form preparation, possible transcription onto coding sheets, keypunching by persons unfamiliar with the data or input formats, and the task of data verification by personal property personnel). These many iterations take both calendar time and personnel time, and all but the last iteration allow room for errors. There is no capability for file querying, and therefore all information is only as current as the latest computer-generated reports. Also, the manual search for information from reports (which may get misplaced) can be quite time consuming.

4.2 QUASI-AUTOMATED SYSTEM

4.2.1 Description

Personal property office personnel would utilize dumb cathode ray tube (CRT) terminals in a key-to-tape data capture and transmission system. Terminals would be located at the desks of interviewers, inbound traffic controllers, and quality control inspectors. Data generated would be transmitted either manually or by telecommunication to the nearest NSC or an alternate ADP facility for input to the automated personal property information system. The terminals would be used primarily to capture data; data transmission would occur only at the end of the day.

At the interviewer's desk, the CRT terminal would be used primarily for the completion of forms required for packing and crating contracts, outbound shipments, and the nontemporary storage of household goods. Therefore, a forms generation capability would be required. Copies of

the completed forms could be generated locally on a printer for retention by the members.

The inbound traffic controller would require a terminal to create or update an inbound shipment record based on the arrival of the member or the household goods carrier. An inbound shipment record would also be created or updated based on information received via the data network, but this should not require any action by the inbound traffic controller.

A terminal would be required at the quality control desk for input of data pertaining to the inspection of outbound/inbound shipments. Since these data would be extracted from shipment inspection data sheets, the use of these terminals could be shared.

An alternative to this system would be to use one or two terminals for forms processing, independent of the member-office interactions. Such a system would be similar to that described in Section 4.1, using the terminal and office personnel to replace card keypunching.

4.2.2 Cost Analysis

Most key-to-tape systems, and all key-to-disk systems, utilize programmable controllers and would therefore not be applicable to a quasi-automated system. Such systems are therefore discussed in Sections 4.3 and 4.4. However, System E is a dumb terminal which can retrieve form images from a cassette, display them on a CRT, and store the completed form data on a second cassette for later telecomunications transmission to a mainframe computer (e.g., the Burroughs B3500).

System E terminals can share cassette units (a maximum of six terminals/cassette unit and a maximum of three terminals/printer). The cost analysis presented in Table 2 assumes that interviewers can utilize the maximum multiplexing capabilities of the terminals, and that personnel who handle inbound traffic could share one terminal between two people, which would require only one printer and one tape cassette. The figures are based on the list price of $2400 per terminal. Note that the manufacturer of System E (or any other comparable manufacturer) would probably bid a lower sale price per unit for a major purchase order, which would reduce the estimated procurement cost.

TABLE 2 - HARDWARE PROCUREMENT COST FOR A QUASI-AUTOMATED SYSTEM

TERMINALS REQUIRED	CASSETTE UNITS REQUIRED	PRINTERS REQUIRED	PURCHASE PRICE ($)	ANNUAL MAINTENANCE ($)	RENTAL (ANNUAL) ($)
1	1	1	5,890	552	3,240
2	1	1	8,290	792	4,416
3	1	1	10,690	1,032	5,592
4	1	2	14,990	1,404	7,764
5	1	2	17,390	1,644	8,940
6	1	2	19,790	1,884	10,116
7	2	3	25,680	2,436	13,356
8	2	3	28,080	2,676	14,532
9	2	3	30,480	2,916	15,708
10	2	4	34,780	3,288	17,880
11	2	4	37,180	3,528	19,056
12	2	4	39,580	3,768	20,232

4.2.3 Advantages

The quasi-automated system offers many features similar to those found in a truly automated operation without the computer programming related problems of such an operation. Form definition with storage on cassette is the only "programming" necessary. The cassette units, as well as the printers, can be multiplexed or shared among terminals.

Field lengths on the form are defined during the form generation phase and checked during the data entry phase to ensure that data entered do not exceed the defined lengths. The keyed data are stored in an internal buffer, so that the completed form can be scanned for completeness and accuracy, and corrected prior to storage on the output cassette. After the completed form is transferred, the same form (or another form, if desired) is displayed on the CRT and the data entry process continues.

4.2.4 Disadvantages

The biggest disadvantage in a quasi-automated system is the lack of "intelligence" of the terminal. There is no capability to query data except by a sequential search which is cumbersome and time-consuming. There is little or no capability for error checking (e.g., alphabetical characters in numeric fields), transfer and/or storage of recurring data fields (e.g., the member's name and address), or automatic completion of data fields requiring calculations. Erroneous data cannot be corrected once they are written on the cassette by System E except by copying the entire tape. Additionally, captured data could not be readily transmitted for the production of other forms (e.g., the GBL, 828, 1164, etc.) unless the forms were produced by the mainframe computer at a later time.

Finally, since no computer compatible peripherals are available (i.e., System E generates cassette output but the B3500 will not accept cassette input), this system must rely on telecommunications for the transfer of data.

In procuring a quasi-automated system, only processor (i.e., CPU) expenses are avoided. However, a processor can be relatively inexpensive, and it provides a multitude of advantages as explained in later sections.

4.3 PARTIALLY-AUTOMATED SYSTEM

4.3.1 Description

The personal property office would utilize a centralized intelligent terminal system in essentially a batch processing mode for forms generation, data capture, input preparation, file query, and to a limited extent report generation. The available hardware would be shared by data entry clerks and inbound traffic personnel. Terminals would not be readily accessible to interviewers or quality control personnel.

Two alternative off-line storage mediums are available with intelligent terminals, tape and disk. As a key-to-tape system, edited data could be stored on either a nine-track computer-compatible magnetic tape or a cassette. However, since the file organization of a tape system is sequential, this alternative could seriously hamper on-line query capability due to the relatively slow response times. This problem will be discussed later when the storage requirements for on-line query are analyzed. In a key-to-disk system, edited data would be stored on a disk or diskette. On-line query of data files would be facilitated by the random access nature of the disk medium, and the data input required for B3500 processing would be transmitted via telecommunications.

Interviewers and quality control personnel would manually complete forms as is presently being done, with the data entry clerk entering data from previous forms. If carrier assignments are made during the interview, the interviewer would leave his/her desk and manually access the traffic distribution roster (TDR) to determine which carrier should be offered the shipment and what, if any, shipment consolidation or grouping is possible. (As previously stated, this process would be more feasible for a disk system than for a tape system). The interviewer would then verify by telephone the carrier acceptance of the shipment and would update the TDR. If carrier assignments and shipment consolidation and groupings are not done during the interview, they could be handled by one operator on a daily basis. (In this case the tape system might not be significantly inferior to the disk approach.) In either case an operator would work full time entering data into the system. Inbound traffic personnel would query the system to determine the status of inbound

traffic and update the records. (Again, the disk approach would be superior due to its random access capability).

4.3.2 Cost Analysis

The hardware costs include the intelligent terminal, printer, and possibly a memory device (preferably a disk to permit random access). Therefore, before detailing the costs of the hardware, it is necessary to determine how much storage space is required, particularly for on-line queries.

It is desirable to minimize the amount of information stored for on-line accessibility, since this will minimize the hardware costs, disk size, and access time. The required data records include inbound shipments, out-bound shipments (for possible shipment consolidation), and the traffic distribution roster. Required and optional information for the three types of data records are shown in Tables 3-5. Required items are those which should be available for on-line access. If optional items are not stored on-line, they will be retained on an off-line storage medium. In the determination of how much storage space is required for on-line access, only required information is considered. Inbound shipments require a total of 164 characters/shipment, and the data are retained for a maximum of 90 days (assuming that inbound data are transmitted from the origin office as soon as possible). The scheduled shipments file requires 55 characters/shipment, and the data are retained for a maximum of 45 days. The traffic distribution file requires 55 characters for each carrier/destination/cost of service and 25 characters/shipment. Data are accumulated for each quarter so that, at the end of the quarter, 91 days of shipment data are stored.

The amount of storage required by a personal property office depends on its size and its workload. Table 6 presents various workload levels and the number of characters which must be stored for each level to permit on-line access. Random access capability again makes disk storage preferable to tape storage for on-line querying. However, several factors affect the selection of the storage medium, such as whether carrier assignments are made during the interview or at some later time,

TABLE 3 - INBOUND SHIPMENT DATA

Required Item	Number of Characters Per Item
Member name	18
Pay grade	2
Social Security number	9
Service	1
Carrier Code	4
Inbound agent code	2
Code of service	1
Shipment number	1
Origin	17
Estimated weight	5
Pick-up date	4
Required delivery date	4
Estimated date of arrival	4
Government bill of lading (or TCMD) number	8
Minimum transit time	2
Date of last estimated date of arrival	4
Date of change	4
Delay reason code	2
SIT at origin	3
Shipment arrival date	4
Date reported	4
Delivery address - Street number	5
Street name	21
County	3
Apartment/lot number	3
Subdivision/city	15
Home telephone	7
Duty telephone	7
Total	164

TABLE 3 - (continued)

Optional Item*	Number of Characters Per Item
Delivery status	1
Reweigh requirement	1
Special handling requirements	8
Overflow	1
Inspection type	1
Inspector code	1
Destination penalty points	25
Document issued	1
Date issued	4
Days authorized SIT	3
SIT agent number	2
SIT control number	7
Date released SIT	4
Port arrival date	4
Port	3
Vessel	14
Diversion/reconsignment	1
Total	90

*These items may be stored off-line

TABLE 4 - SCHEDULED SHIPMENTS DATA

Required Item	Number of Characters Per Item
GBL or TCMD number	8
Date of GBL or TCMD	4
Carrier code	4
Agent code	2
Code of service	1
Tariff code	1
Estimated weight	5
Destination	17
Destination code	5
Earliest scheduled pick-up date*	4
Latest scheduled pick-up date*	4
Total	55

Optional Item**	Number of Characters Per Item
Name	18
Grade	2
Service	1
Social security number	9
Shipment number	1
Required delivery date	4
Pick-up address - Street number	5
Street name	21
County	3
Apartment/lot number	3
City	15

*If two shipments already consolidated

**These items may be stored off-line

TABLE 4 (continued)

Optional Item**	Number of Characters Per Item
Phone number	7
Application date	4
SIT at origin	3
Special handling	8
Consolidation	2
Grouping	2
Inspection	1
Inspector	1
Award date	4
Pack date	4
Minimum transit time	2
Actual weight	4
Cost (move)	7
Cost (accessorial services)	6
Pick-up status	1
Overflow	1
Depart date	4
Reweigh request	1
Origin penalties	19
Destination penalities	25
Document type	1
Date of document	4
Turnback/cancel	1
Port	3
Port departure date	4
Vessel	15
Total	216

**These items may be stored off-line

TABLE 5 - TONNAGE DISTRIBUTION DATA

Required Item (for each carrier-destination)	Number of Characters Per Item
Carrier name	17
Carrier code	4
Code of service	1
Tariff code	1
Destination	20
Geography (foreign or domestic)	1
Local agent code	2
Low cost rating	2
Quarter	3
Performance classification category	1
Last performance score	3
Total	55

Required Item (for each shipment)	Number of Characters Per Item
Booking date	4
GBL number	9
Estimated weight	5
Cumulative weight	7
Total	25

TABLE 6 - ON-LINE STORAGE REQUIREMENTS

Inbound or Outbound Shipments/Quarter	Data Characters/ per Quarter	Carrier/Destination/ Code of Service Records	Data Characters Required
5000	1,082,500	4000	220,000
2000	433,000	3000	165,000
1000	216,000	2000	110,000
500	108,250	1000	55,000
250	54,125	500	27,000
125	27,063	100	5,000

the price of the disk, and whether the size of the office warrants the cost.

If the cassette approach is used, one cassette drive will be dedicated to the storage of files for on-line query and the rest of the drives (one or two) will be used for program storage and data capture.

The cassettes of various manufacturers can store between 80,000 and 240,000 characters, the average being 150,000 characters/cassette. (Appendix B). As shown in Table 6, an office with 5000 shipments/quarter would not be able to use cassettes as a storage medium because there is simply too much data. A one-million-character disk would be more appropriate. However, any office having less than 500 shipments/quarter (approx. 110,000 characters) could conveniently use cassette storage. On the basis of past data (Table 7) it appears that possibly up to one-half of the Navy personal property offices handle less than 500 shipments/quarter and therefore could use cassettes.

Table 8 presents the cost data for a single intelligent terminal. Cost totals for the four manufacturers are presented for hardware with and without disk storage. A range of costs for a system with disk storage is shown depending upon the size of disk chosen. Maintenance is usually included in the cost for purchase. Maintenance costs for purchases are based on the procurement of a maintenance contract.

4.3.3 Advantages

A "back-room" terminal would provide the PPTO with an on-line data retrieval system. Inbound traffic personnel would be able to directly query or update a member's record to determine the status of a personal property shipment. Thus, all inbound records would be continually maintained with up-to-date information and would be readily visible to the member.

Tonnage distribution and shipment consolidation could be accomplished automatically (but still verified manually by a telephone call to the carrier to determine whether he can accept the shipment).

Telecommunication of the captured data eliminates many errors by reducing human intervention, delays caused by the postal system, or the mishandling of shipment of documents.

TABLE 7 - PERSONAL PROPERTY TRANSPORTATION OFFICE WORKLOADS*

ACTIVITY NAME	ANNUAL WORKLOAD	ACTIVITY NAME	ANNUAL WORKLOAD
ANACOSTIA**	5625	MAYPORT	4535
ANNAPOLIS	3058	MCALISTER	3990
ATHENS	1374	MECHANICSBURG	2370
SOUTH WEYMOUTH	6750	MEMPHIS	6750
BRUNSWICK	5869	MERIDIAN	3189
CHARLESTON	17449	MONTEREY	5007
CHINA LAKE	450	NEW LONDON	8205
CLEVELAND	11158	NEW ORLEANS	10557
CORPUS CHRISTI	9860	NEWPORT	14881
CRANE	3605	NORFOLK	44711
DAHLGREN	313	OAKLAND	38666
DALLAS	5294	ORLANDO	3664
ELCENTRO	556	PANAMA CITY	321
FALLON	930	PATUXENT RIVER	2451
GREAD LAKES	14209	PENSACOLA	14400
GULFPORT	208	PHILADELPHIA	8054
HAWTHORNE	800	PORT HUENEME	7217
IDAHO FALLS	2200	PUGET SOUND	8012
INDIANHEAD	1051	SCOTIA	7160
JACKSONVILLE	9171	SAN DIEGO	36377
KEY WEST	94	VALLEJO**	4000
LAKEHURST	2430	WARMINSTER	3674
LEMOORE	4879	WHIDBEY ISLAND	3733
LONG BEACH**	15899	YORKTOWN**	800
MARIETTA	1749		

* Sum of inbound and outbound shipments, based upon FY-73 data
** Indicates processing office only

TABLE 8 - COST OF A SINGLE INTELLIGENT TERMINAL SYSTEM
(in dollars)

Equipment	Annual Rental	Installation	Purchase	Annual Maintenance
SYSTEM A				
with three cassettes[1]	6936	-	14,709	735[3]
with 26K-byte disk[2]	8124	-	17,261	863[3]
with 786K-byte disk[2]	8400	-	17,856	893[3]
with 2.5M-byte disk[2]	11,052		23,616	1181[3]
SYSTEM B				
with one cassette	8340	-	22,330	1688[3]
with 2.3M-byte disk	16,956	-		3036[3]
SYSTEM C				
with dual cassettes[1]	6264-7428	245	13,640-17,336	96
with 256K-byte diskette	6588-7704	275	15,401-21,934	101
with 786K-byte disk[2]	11,232-12,960	335	22,899-26,865	170
with 2.5M-byte disk[2]	11,196-13,044	365	25,917-30,190	140
SYSTEM D				
Triple cassette system[2]	8940	440	22,911	103
Dual floppy disk system[2]	9125	385	25,511	103

[1]Based on a machine with 8K memory.

[2]Based on a machine with 16K memory.

[3]Includes rental of modem.

4.3.4 Disadvantages

Data from interviewers and quality control inspectors would still probably be transcribed from forms and verified for transcription accuracy. Having only one terminal in a large personal property office would probably result in a queue building up to use the terminal; the data entry clerk would be interrupted by inbound traffic personnel simultaneously trying to determine the status of several members' shipments. If the carrier is assigned during the member interview, then the "instant" determination of household goods carrier's availability would further increase the queue problem.

If a large personal property office had two or more terminals accessing the same storage device, the system would require a multiplexing or "cluster" capability and would be essentially a fully-automated system, as described in the next section.

4.4 FULLY-AUTOMATED SYSTEM

4.4.1 Description

A fully-automated system would provide an intelligent terminal capability to all interviewers, inbound traffic personnel, and quality control personnel (on either a one-to-one or shared basis). The appropriate personal property documents (for shipment or storage) would be displayed on the CRT, completed by the interviewer using input from the member, edited using the terminal's field checking capabilities, and visually monitored for accuracy by both the member and the interviewer. A copy of the completed document would be printed and presented to the member for his retention. Quality control personnel would utilize the intelligent terminal for entering data pertaining to the inspections of personal property shipments. Inbound traffic personnel would use the terminals to monitor and update the status of inbound shipments. In all cases, terminal-generated forms displayed on the CRT would be used to enter all data.

Data would be checked both visually and mechanically for format and content to the maximum extent possible. Captured data would then be either stored on a disk or tape, or restructured for transmission to a B3500 via telecommunications.

4.4.2 Cost Analysis

The costs for single intelligent terminals are given in Table 8. The cost for a multiple intelligent terminal system is not necessarily an integral multiple of the cost for a single system, a multiple terminal system could consist of "clustered" terminals sharing processors or peripheral hardware.

Of the four terminals discussed in the previous section, only System D does not have a clustering capability. The System A terminal is designed to multiplex up to four terminals with the disk; the System C terminal can multiplex a maximum of eight terminals to a disk. System B can multiplex up to ten terminal displays to one CPU, with up to eight CPU's multiplexed to one disk. Consequently, the cost for a system of four terminals is simply the cost of a one-terminal system (i.e., terminal plus peripherals) plus the cost for three terminals. Each of the terminals in Systems A and D includes a CPU. No additional CPUs are required for System B or System C.

The costs for a system with from one to eight intelligent terminals, based on the cost information presented in Table 8, are shown in Table 9. Prices shown for System B and System C are for one disk and one printer. The price of System A includes two disks and two printers for more than four terminals, System A can multiplex only four terminals per disk, and at least one printer is required for each disk. All System A terminals have 16K bytes of memory; the System B and System C terminals have no intelligence of their own, but are connected to intelligent processors which contain 16K bytes of memory.

4.4.3 Advantages

A shared or individual terminal available to each interviewer, will allow direct entry of data into the computer system and eliminate many sources of possible error. Using an intelligent terminal to process the data allows automatic error checking for both format and, to a limited extent, content. Displaying the completed form on a CRT allows the member to verify the accuracy of the entered data. The interrogation/data entry capability of a random access storage device such as a disk allows the interviewer to query a tonnage distribution file, determine the

TABLE 9 - COST[1] OF CLUSTERED INTELLIGENT TERMINALS ($K)

Number of Terminals	System A			System B			System C		
	Purchase	Annual Maint.	Annual Rental	Purchase	Annual Maint.	Annual Rental	Purchase & Install.	Annual Maint.	Annual Rental
1	14.7-23.6	.9-1.3	6.9-11.0	22.3-46.1	1.7-3.0	8.3-17.0	16.3	1.2	6.1
2	23.2-29.6	1.2-1.5	10.9-13.8	47.7	3.4	18.5	28.9	2.1	10.3
3	29.2-35.5	1.5-1.8	13.6-16.5	49.3	3.7	20.1	30.4	2.3	11.1
4	35.1-41.5	1.8-2.1	16.4-19.3	50.8	4.0	21.6	32.0	2.4	11.8
5	52.4-65.1	2.6-3.3	24.5-30.3	52.4	4.4	23.1	33.6	2.5	12.6
6	58.3-71.0	2.9-3.6	27.2-33.1	53.9	4.7	24.7	35.2	2.6	13.4
7	64.3-77.0	3.2-3.8	30.0-35.8	55.5	5.0	26.2	36.8	2.7	14.1
8	70.2-82.9	3.5-4.1	32.7-38.6	57.0	5.4	27.8	38.3	2.9	14.9

[1]Prices range from cassette to largest disk for one terminal, and from smallest disk to 2.5M-byte disk for two or more terminals. All terminals have 16K bytes of memory (the minimum configuration for System B and System C).

identity of the next qualified carrier, and telephone him to verify his acceptance of the member's personal property shipment if such assignments are made at the time of the interview.

Inbound traffic records will be created or updated whenever the origin shipment office records arrive (by mail or telecommunications), or when the member or carrier notifies the office of his arrival. This on-line query/update capabilty will guarantee the accessibility, currency, and accuracy of member records.

Direct access to inbound records by quality control personel will provide the capability for entering inspection records directly into the inbound shipment record and for concurrently organizing the inspection results for transmission to the origin office.

4.4.4 Disadvantages

There are no operational disadvantages in a fully automated system.

4.5 HYBRID SYSTEM

4.5.1 Description

A hybrid system would use a dumb terminal for forms generation and data capture (as in the quasi-automated system) and an intelligent terminal system for on-line file query and file maintenance. Use of a hybrid system would be most effective only if the intelligent terminal could process the data prepared on the dumb terminal, either by reading the tape casette or by receiving the data via intra-office telecommunications. The present total lack of standardization among manufacturers in the methods used for reading and writing tape cassettes probably precludes the compatibility of one manufacturer's cassette with another manufacturer's machine. The use of telecommunications to transmit data requires both types of terminals to have telecommunications capability, requires compatible transmission formats, and ties up two separate telephones during the daily data transmission/data consolidation phase of operation.

The interviewers would use the dumb terminal for forms generation and capture, as described in Section 4.2. Quality control inspectors would use the dumb terminals for forms generations and data capture also.

However, inspectors are primarily involved in adding data to a member's record, rather than in creating or deleting the record. Since record additions are based on shipment inspections, and since a schedule of inspections can be generated by computer, the B3500 can generate the inspection forms for CRT display on the dumb terminal. The quality control personnel would only "fill in the blanks" of the displayed forms for each scheduled shipment. This would assure that data are generated and that quality control personnel are relieved of the task of generating identification data for each record.

Inbound traffic personnel would use the intelligent terminal in a manner similar to that described in Sections 4.3 and 4.4. It is probable that they could share one or more terminals, and thus reduce the cost of the system.

4.5.2 Cost Analysis

The cost of a hybrid system is a combination of the costs for dumb terminals and the costs for a single intelligent terminal system or the costs for a multiple intelligent terminal system. The cost of a hybrid system therefore is comparable to the cost of a fully-automated system, since a good intelligent terminal system consists of a dumb CRT connected to an intelligent processor.

4.5.3 Advantages

A hybrid system provides the PPTO with an on-line data retrieval system. Inbound traffic personnel would be able to establish, query, or update inbound traffic records whenever the origin shipment office records arrive, or when the member or carrier notifies the office of his arrival. This on-line query/update capability guarantees the accessibility, accuracy, and timeliness of member records.

Input preparation by terminal forms generation and completion eliminates many of the opportunities for human errors, as well as extra copies of paper forms.

Display of quality control forms (e.g., MTMC form 229, the CERS Shipment Evaluation and Inspection Record document) provides quality

control personnel with the capability to enter only inspection data, and not record identification data.

4.5.4 Disadvantages

The ability to take a cassette written by one manufacturer's dumb terminal and read it with another manufacturer's terminal is feasible in theory but doubtful in practice due to the lack of standardization among manufacturers. The only other means for transfer of data between terminals is by telecommunications, which requires the use of at least two office telephones.

5 CONCLUSIONS

Since personal property transportation offices vary significantly in size, requirements, and resources (manpower and monetary), it would be difficult and unrealistic to choose one optimum alternative from the five presented for implementation at all offices. Rather, it is preferable to choose suitable configurations for each office, and to seek an integration of the various configurations into a viable system. The alternative chosen for a particular office depends on the benefits derived and costs incurred for the particular office, and the benefits and costs realized by the system as a whole. Some initial statements can be made, however, regarding analysis of cost and the definition of benefit factors.

Figure 8 compares the costs for keypunching and for buying or renting an intelligent terminal system. The variation in the cost of keypunching reflects both the high and low rates. The variation in the cost of an intelligent terminal system reflects the range of costs for the minimum and maximum capabilities, i.e., from a cassette system to a large disk system for one terminal, and different size disk systems for more than one terminal. It should be remembered that the systems investigated are only representative samples. For example, keypunch costs are those negotiated by David W. Taylor Naval Ship Research and Development Center (DTNSRDC) in Washington, D.C. in 1975. Keypunch rates may vary significantly with geographical location, since they depend on competitive wage rates, the cost of living, etc. Inflation and technological advancements are narrowing the gap between keypunch costs and hardware costs. Keypunch costs are going up due to inflation, but hardware costs, despite inflation, are going down due to advances in technology. In addition, an IFB (invitation for bids) may provide even lower hardware costs.

The cost data reflected in Figure 8 represent only hardware procurement costs. However, a comparison of the costs for keypunching, rental of dumb terminals, and rental of an intelligent terminal system indicates that an intelligent terminal system is feasible if the higher keypunch costs are considered and if it is assumed that a large (approximately

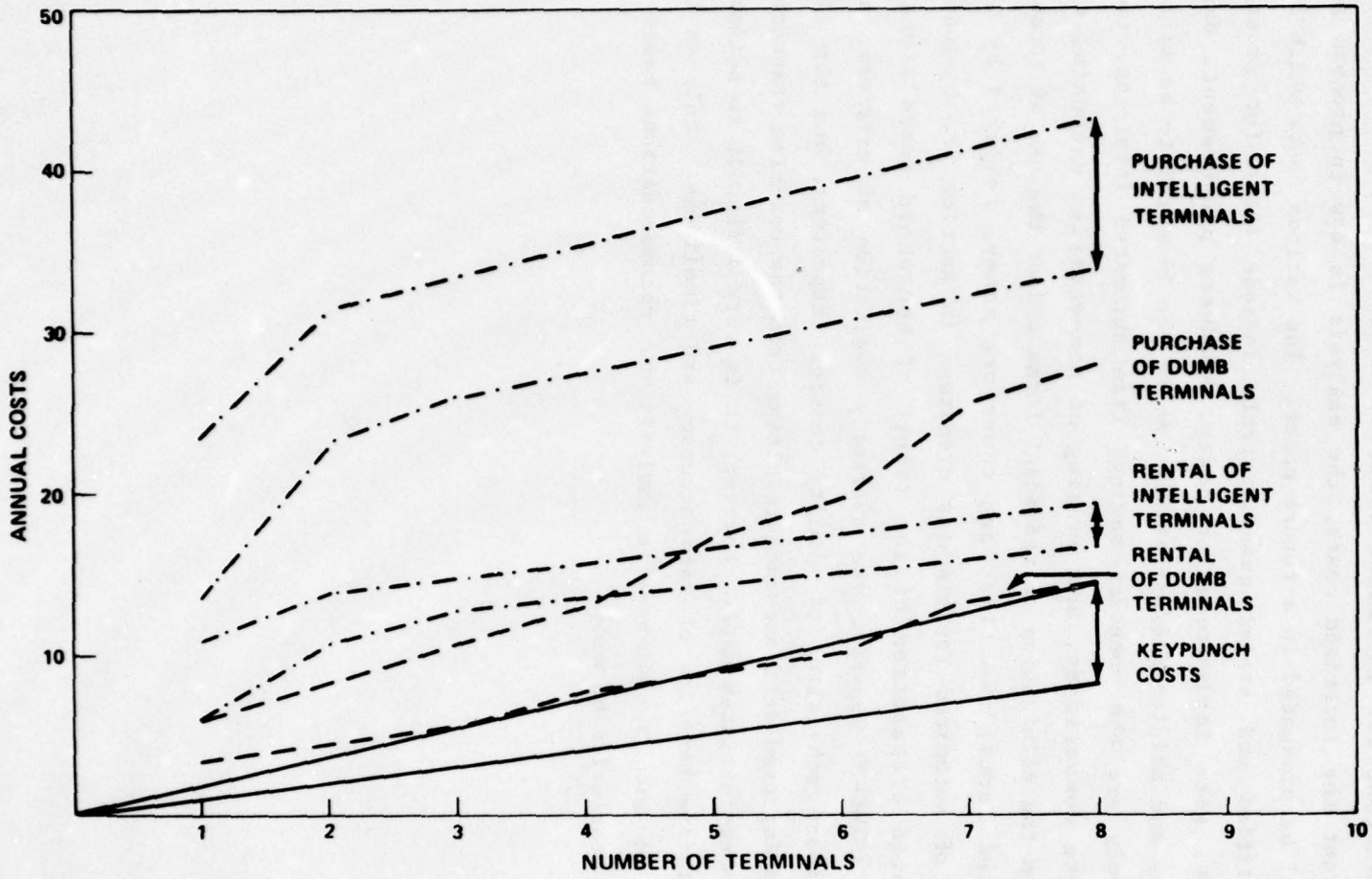


Figure 8 - Costs of Alternative Systems (SK)

40,000 inbound/outbound movements per year) personal property office will use eight terminals. A complete cost-benefit analysis is needed to determine whether the increased benefits of an intelligent terminal system warrant the increased costs; the analysis is now in process and results will be presented in a future paper. The various costs which are being identified and stated quantitatively include those for program development, site implementation costs, hardware procurement, data preparation, and maintenance/operation. Among the benefits to be stated quantitatively are the monetary savings from automated invoicing, contractor rate comparisons, and purging of non-entitled accounts; the savings from the elimination of redundant forms and/or the use of computer generated forms; the time, and therefore money, realized by the generation of automated reports (as discussed in Section 2), including the automated preparation of the report of household goods storage activities (MTMC-20 Report), the quarterly evaluation of carriers, and the preliminary scheduling of quality control inspectors; and the time savings and improved data accuracy resulting from the one-time transcription of member-initiated data. However, it is very difficult to estimate the quantitative benefits of data accuracy and timeliness. Only on the completion of such a cost-benefit analysis can recommendations based on meaningful statistics be made.

APPENDIX A
CURRENT SYSTEM

Whenever a member of the military forces, or under certain circumstances a civilian employee, is required to make a permanent change of station (PCS) move, the member is entitled to the transportation and/or nontemporary storage of his personal property. Personal property may include household goods (HHG), unaccompanied baggage, a privately owned vehicle, and/or a house trailer. The transportation of household goods includes shipment, packing, crating, drayage, temporary storage, uncrating, and unpacking. The nontemporary storage of household goods includes packing, wardrobes, drayage to the storage facility, handling into the facility, storage, handling out, drayage out, and unpacking. The personal property office is responsible for making the necessary arrangements for such shipments and/or storage. The Personal Property Transportation Officer (PPTO) is responsible for the development, coordination, and supervision of DOD-wide programs, procedures, reports, standards, and criteria governing the procurement of services required to move, store, and handle personal property.

A typical counseling session scenario is as follows: The member enters the personal property office, logs in his time of arrival, and waits to be served. At some offices he may schedule an appointment in advance. When an interviewer becomes available, the member presents the original and two extra copies of his orders and is counseled on his entitlements and options. The options available to the member may include nontemporary storage of his household goods, shipment of household goods to his new duty station or a closer CONUS location, packing and shipment of baggage, and packing and shipment of high value items. In a domestic move the member may also ship a mobile home or he may choose the "do-it-yourself" option, in which case the member rents a truck or trailer at government expense and physically moves his own goods. In an international move or change of home port, the member may also ship a privately owned vehicle (POV). In any case the total weight of household goods to which the member is entitled is determined by his rank/rate. For each option chosen (nontemporary storage, shipment to

new duty station, shipment to other location in CONUS, shipment of POV etc.), the interviewer must complete a DD Form 1299, "Application for Shipment and/or Storage of Personal Property," based upon information contained in the member's orders, supplied by the member himself, or determined by the interviewer. The required delivery data (RDD) of the personal property shipment is determined by the requirments of the member. However, the mode of transportation to meet the date will be chosen by the personal property transportation officer. In the case of household goods shipment, the interviewer tries to honor the member's preference for a specific carrier. The member may also reject a carrier, but only one rejection is allowed. If the member has no preference, the interviewer may consult the traffic distribution register (TDR), which is a record of the total tonnage awarded during the current fiscal year to each carrier serving a specific destination. The PPTO attempts to make tonnage awards on an equitable basis for low cost carriers serving the same destination area or, if the Carrier Evaluation and Reporting System (CERS) is in effect, he may make assignments on a weighted basis, based on quality of service and cost. The interviewer may try to perform a preliminary shipment consolidation with one carrier if, for a given destination area, two or more shipments are scheduled for pick-up within a three-day period. The primary purpose of this consolidation is to improve service; however, better rates and lower overall cost to the government may also result. In this case the carrier chosen is not necessarily the low tonnage carrier on the TDR but the PPTO will ensure that tonnage awards are equalized over the fiscal year. The interviewer may telephone the selected carrier immediately to determine whether he will accept the move, or contact may be made after consolidation possibilities are explored. The interviewer maintains the TDR by adding the estimated tonnage to the record for each carrier offered the shipment, regardless of whether it is accepted or refused by the carrier. If the shipment is refused, the next low-tonnage carrier is contacted. If the move is international, the appropriate Military Ocean Terminal (MOT) is also contacted. If the household goods are to be placed in nontemporary storage, the interviewer provides the contractor with a government service order number for the

requested service at the time of the contractor's acceptance. The contractor, in turn, provides the personal property office with the storage lot number. These contracts are made in the presence of the member, if possible, and at the end of the interview/application session the member signs and receives a copy of all forms pertaining to the transfer and/or storage of his personal property. The interviewer/counseling session is finished and the member departs.

The completed 1299 forms may then go to the traffic manager who makes the final decision concerning shipment consolidation. He may also determine the routing structure for the carrier. The data from the completed DD forms 1299 are then used to generate a DD form 1164, "Service Order for Household Goods", for nontemporary storage; a DD form 1155, "Order for Supplies and Services", for do-it-yourself moves, packing and crating, local drayage, etc.; and a DD Form 1103, "Government Bill of Lading" or a DD form 1384, "Transportation Control Movement Document", for the transporation of household goods, the shipment of baggage, and/or the shipment of high value items.

If personal property is being shipped, the office originating the movement (called the outbound office) must mail the necessary documentation to the destination or inbound office. When the information is received at the inbound office, it is used to establish a manual inbound status file. The file may also be established by the arrival of the carrier with a shipment or the arrival of the member. In any case the inbound office is aware that a move is in progress.

If the shipment arrives but the member is not ready or able to take delivery, the member is entitled to have the goods placed in temporary storage-in-transit (SIT) for a maximum of 90 days. Under certain circumstances, this period can be extended an additional 90 days. When a member is able to receive his property, the goods are delivered.

Carriers are evaluated on the basis of many move-related factors. Under the Carrier Evaluation and Reporting System (CERS), each carrier receives a numerical score based on his semi-annual aggregate performance and is assigned to one of four categories for the purpose of tonnage

distribution. The evaluation is based on both the member's judgment of origin and destination performance, the reports filed by the quality control inspectors at either the inbound or the outbound offices, or both. Normally, however, only 50% of the shipments are inspected. The final compilation and computation of carrier scores is based on information contained on MTMC form 229, "Shipment Evaluation and Inspection Record", and MTMC form 1781, "Customer Satisfaction Report".

Goods destined for nontemporary storage are stored at the outbound office by a qualified storage contractor. Since rates for storage and various related services vary, the PPTO must perform a cost comparison. Records of lots in storage, payment for storage and services, and various managerial reports are also generated.

The required forms for the various options are listed in Table A1. Figure A1 describes the forms generation and distribution process with accompanying narrative. It also indicates the areas which may be automated and those which require human intervention. Figures A2, A3, and A4 describe the flow of personal property information for domestic movements; Figures A5, A6, and A7 descibe those for international moves.

TABLE A1 - PERTINENT PERSONAL PROPERTY FORMS

DOD or MTMC FORM NUMBER	FORM NAME	FORM PURPOSE	DISTRIBUTION
MT 229	SHIPMENT EVALUATION AND INSPECTION RECORD	Collection of performance data throughout entire shipment cycle	Destination Office Carrier's home office Carrier performance file at origin office
DD 828	MOTOR VEHICLE SHIPMENT APPLICATION	Shipment of a Privately Owned Vehicle	Member Member File Port of Shipment
DD 1103	GOVERNMENT BILL OF LADING	Contractor Carriage, Receipt for Goods, and Document of Title	Member File Destination Regional Finance Carrier Contractor File
DD 1155	ORDER FOR SUPPLIES AND SERVICES	Pack and crate contracts, trailer rentals (Do-it-yourself), etc.	Member File Regional Finance Contractor Numerical File Contractor File
DD 1164	SERVICE ORDER FOR HOUSEHOLD GOODS	Nontemporary storage of household goods	Member File Regional Finance Center Contractor Regional Storage Management Office Numerical File Contractor File

TABLE A1 -PERTINENT PERSONAL PROPERTY FORMS (Cont.)

DOD or MTMC FORM NUMBER	FORM NAME	FORM PURPOSE	DISTRIBUTION
DD1299	APPLICATION FOR SHIPMENT AND/OR STORAGE OF PERSONAL PROPERTY	Shipment and/or storage of personal property	Member Quality Control Member File Destination PPTO Regional Finance Center Contractor/Carrier
DD1384	TRANSPORTATION CONTROL MOVEMENT DOCUMENT	Movement and control of property within the Defense Transportation System	
MT1781	CUSTOMER SATISFACTION REPORT	Primary supporting document to Form 229 in the determination of a carrier's performance	Origin Transportation Office

FORMS GENERATION AND DISTRIBUTION
COMMENTS ON FIGURE A1

1. The shipments of household goods, POV's, mobile homes, packed and crated goods, and high value items require the completion of a Government Bill of Lading (GBL) for commercial shipment and/or a Transportation Control Movement Document (TCMD) for government shipment. Permanent station data, rates, possible shipment consolidation, and other factors support the completion of these documents. Copies of the GBL go to the inbound PPTO, the Regional Finance Center, the carrier, the member's file, and the contractor's file.

2. The do-it-yourself, pack and crate, and high value options require the completion of an Order for Supplies and Services (DD Form 1155) or similar form. Permanent station data, rates, and other information facilitate the document completion. Copies of the completed document are sent to the Regional Finance Center, the contractor, and the member's file, the contractor's file, and the completed forms file which is numerically organized.

3. The nontemporary storage option requires the completion of a Service Order for Household Goods (DD Form 1164). The completion of the 1164 is supported by the contractor basic agreement number, the lot number, address, rates, appropriation data, permanent station data, expiration date, maximum weight, and other factors. Copies of the 1164 are distributed to the Regional Storage Management Officer, the member's file, the contractor's file, the completed Service Order forms file, the contractor, and the Regional Finance Center.

4. The shipment of a POV requires the completion of a Moter Vehicle Shipment Application (DD Form 828), copies of which go to the member, the member's file, and the port of shipment.

5. Copies of the 1299's and the member's orders are sent to the member's

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6. A copy
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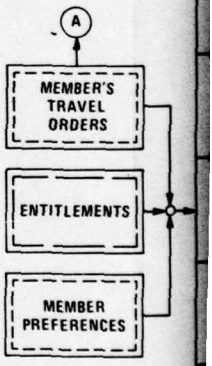

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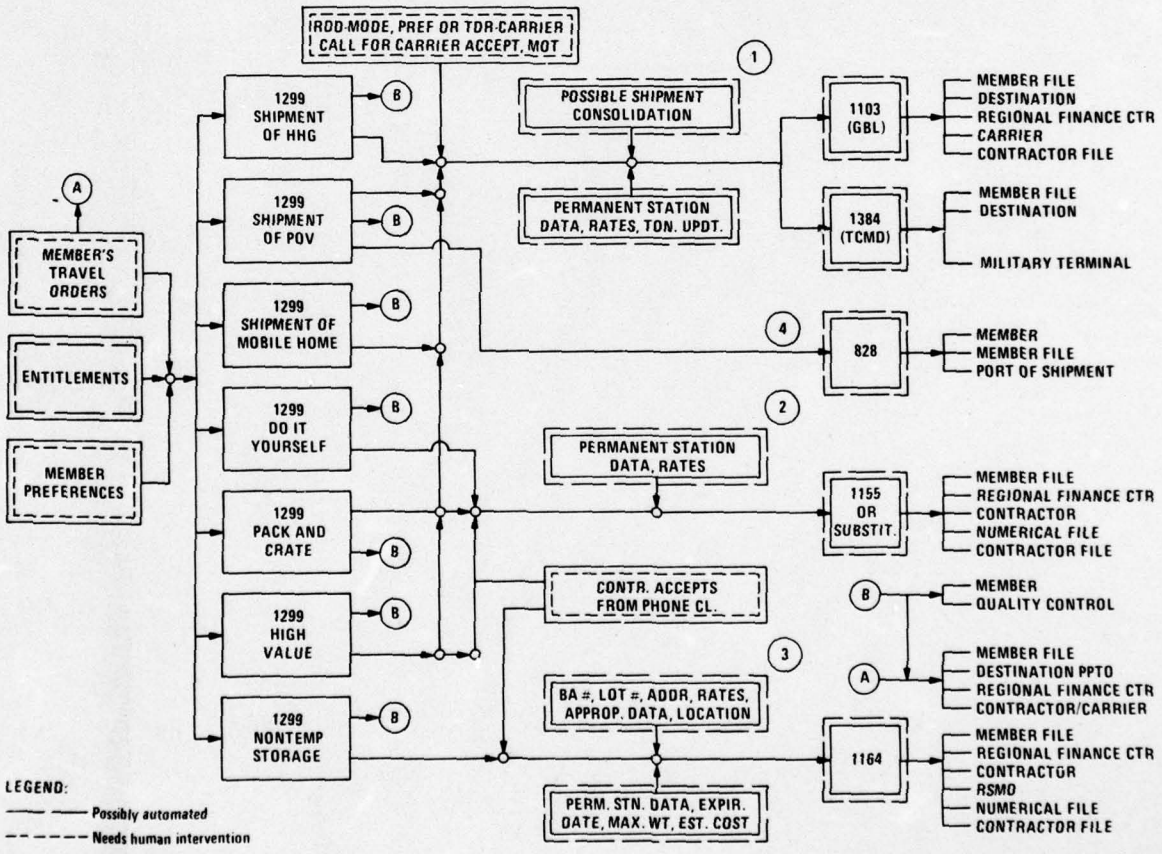
file, to the inbound PPTO, the Regional Finance Center, and the contractor/carrier (accompanying the GBL).

6. A copy of the 1299 is sent to the quality control branch at the outbound office, in addition to the copy kept by the member and the copies distributed to the elements listed in note 5.



Note: Circled numbers refer to comments

Figure A1 - Forms Generation And Distribution

PERSONAL PROPERTY INFORMATION FLOW FOR
DOMESTIC MOVEMENT
COMMENTS ON FIGURE A2

1. As previously described, the member communicates with the interviewer at the Personal Property Transportation Office (PPTO) to arrange for the shipment of his/her personal property.

2. Support documents are generated and exchanged. Copies are sent to the concerned parties, the most important being the inbound PPTO. As previously mentioned, the warehouse storage contractor, household good contractor, etc., are also contacted via telephone.

3. For nontemporary storage the warehouse contacts the member for the pre-move survey. After the survey, the contractor itemizes and packs the goods and then moves them to his warehouse for storage.

4. On the agreed upon pick-up date, either the van (TGBL) or common carrier (DPM) picks up the goods at the owner's residence for transportation to the destination. The movements for van and DPM are shown in Figures 2B and 2C respectively.

5. The personal property is delivered to the destination residence. Refer to Figures 2B and 2C.

6. In the "do-it-yourself" option the member physically transfers his own property from his residence at origin to his destination residence.

7. If the member is entitled to a privately owned vehicle (POV) shipment, he delivers his POV to the closest designated Military Ocean Terminal (MOT) with service to the desired destination. The POV is then transported by the Military Sealift Command (MSC) to the destination MOT and is subsequently picked up by the member.

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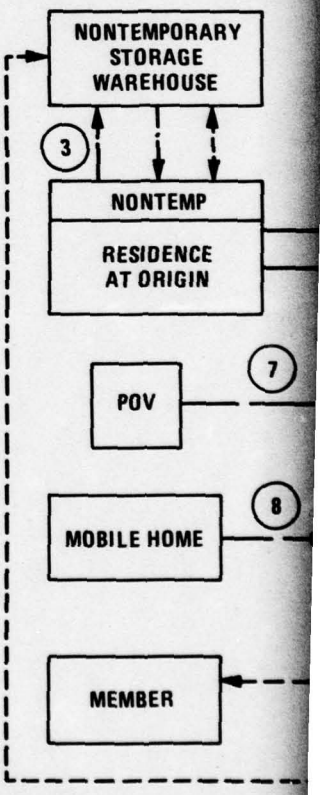

Figure

8. When a mobile home is transported, one carrier executes the entire move from origin to destination.

9. It is the member's duty to notify the inbound PPTO of his arrival at his new duty station and of an address for delivery of his HHG's as soon as he has secured a residence.

10. There are three ways in which the inbound PPTO is alerted that a shipment is on its way or has arrived: (1) The move documentation from the outbound PPTO arrives at the inbound PPTO; (2) The member arrives and contacts the inbound PPTO; (3) The carrier arrives and contacts the inbound PPTO.

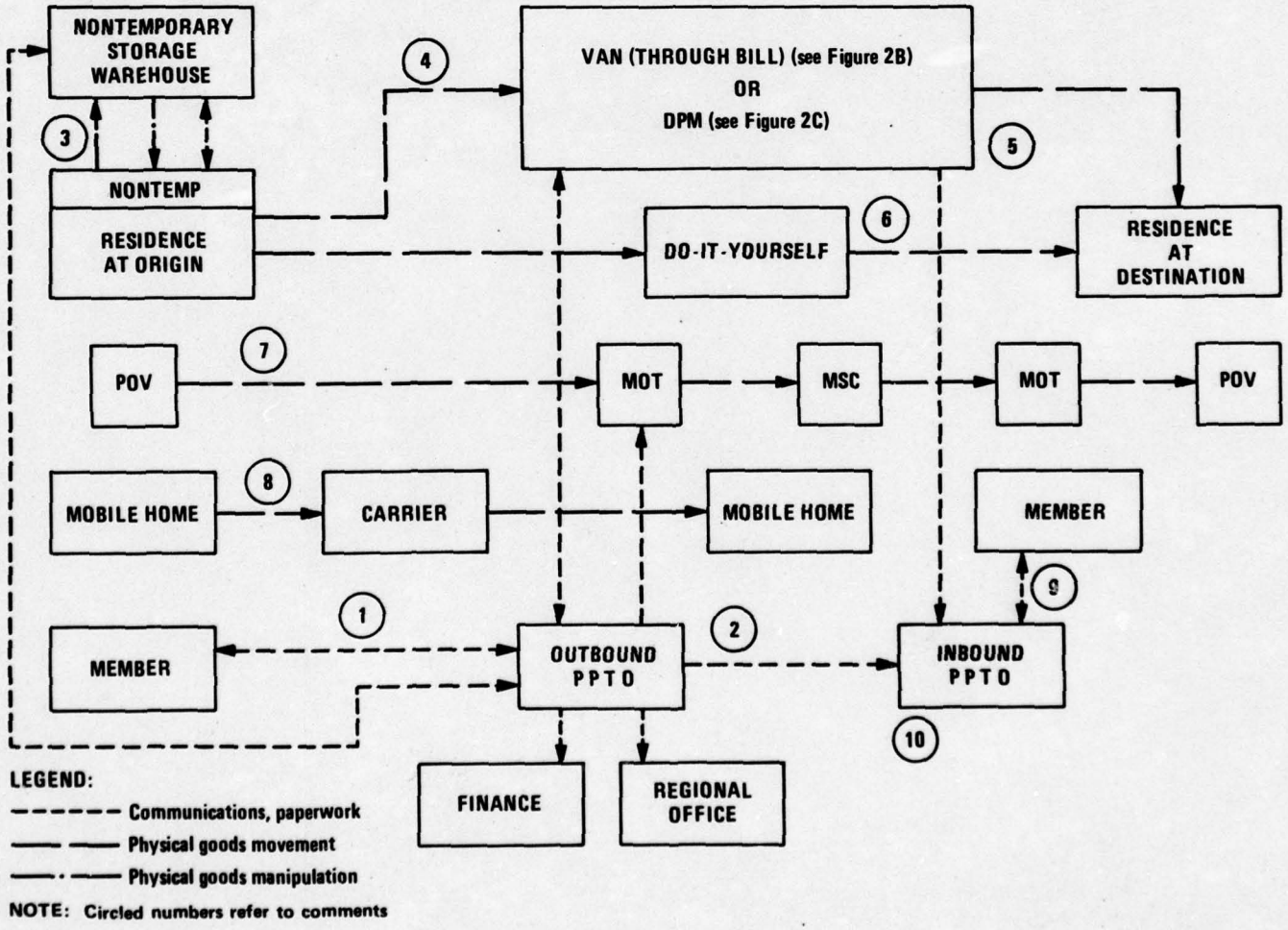

Figure A2 - Personal Property Information Flow For Domestic Movement

VAN (THROUGH BILL) MODE FOR
DOMESTIC MOVEMENT
COMMENTS ON FIGURE A3

1. The communications, paperwork, and pickup date are established at the PPTO for van movement.

2. The personal property is packed and loaded on the van for transportation to the destination.

3. If the van carrier has a destination agent, the goods are transported to the agent's facilities.

RESIDENCE AT ORIGIN

4. The inbound PPTO is notified that the shipment has arrived.

5. The destination Installation Transportation Officer (ITO) has three working hours to provide the address of the member's residence and arrange for the delivery before the government is charged for transportation overtime.

OR

6. The ITO has one hour to decide to put the household goods into temporary storage-in-transit (SIT).

7. If the goods have been placed in SIT, they will be delivered and unpacked when the member supplies his residence address.

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——— Physical
——·—— Physical

Note: Circled numbe

8. If the van carrier does not have an agent, he contacts the inbound PPTO.

9. On the basis of availability of a delivery address, the ITO decides to deliver the goods.

OR

10. The ITO decides to place them in SIT, in which case the van carrier must contact a warehouse acceptable to the government and deliver the property. If requested, the ITO provides to the carrier the names of warehouse contractors.

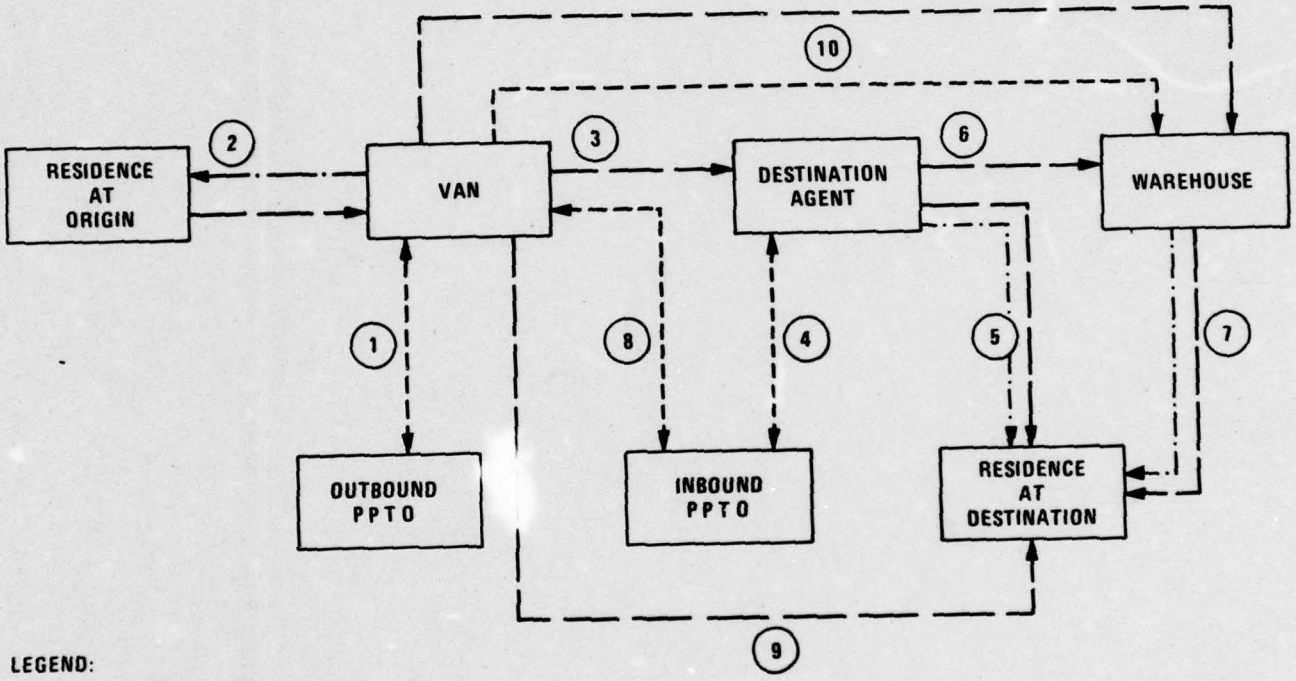


Figure A3 - Van (Through Bill) Mode For Domestic Movement

DPM MODE FOR DOMESTIC MOVEMENT
COMMENTS ON FIGURE A4

1. The outbound PPTO establishes communications, paperwork, and pack and pick-up dates with the various contractors.

2. On the agreed upon pack date, the pack-and-crate contractor arrives at the member's residence to pack his baggage, with high value items and/or household goods. The high value items are left at the residence. The packed household goods may be left at the residence.

3. Packed baggage is transported to the pack-and-crate contractor's warehouse. The packed household goods may also be transported to the warehouse.

4. On the selected data the common carrier picks up the high value items and/or household goods at the member's residence.

OR

5. The common carrier picks up the household goods at the pack-and-crate contractor's warehouse.

6. The personal property is delivered to the common carrier's terminal.

7. The property is then transported to the haul-and-uncrate contractor.

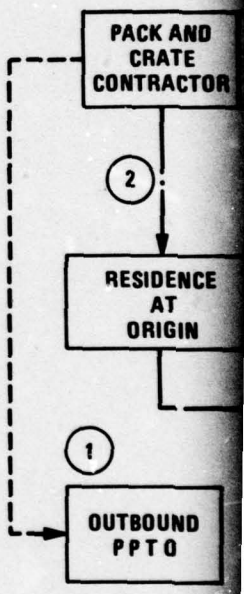
8. The haul-and-uncrate contractor contacts the inbound PPTO.

9. The PPTO must decide whether the property should be delivered and uncrated at the destination residence

OR

10. The property should be placed in SIT at the warehouse.

11. Property placed in SIT is then delivered at some later date. Again, the availability of the residence address and the presence of the member govern the decision.



12. The baggage is taken from the warehouse and delivered to the air or water terminal for transportation to the destination terminal.

13. At the destination terminal the baggage is picked up by either a common carrier (in which case steps 6 through 11 are followed)

OR

14. By the haul-and-uncrate contractor (in which case steps 8 through 11 apply).

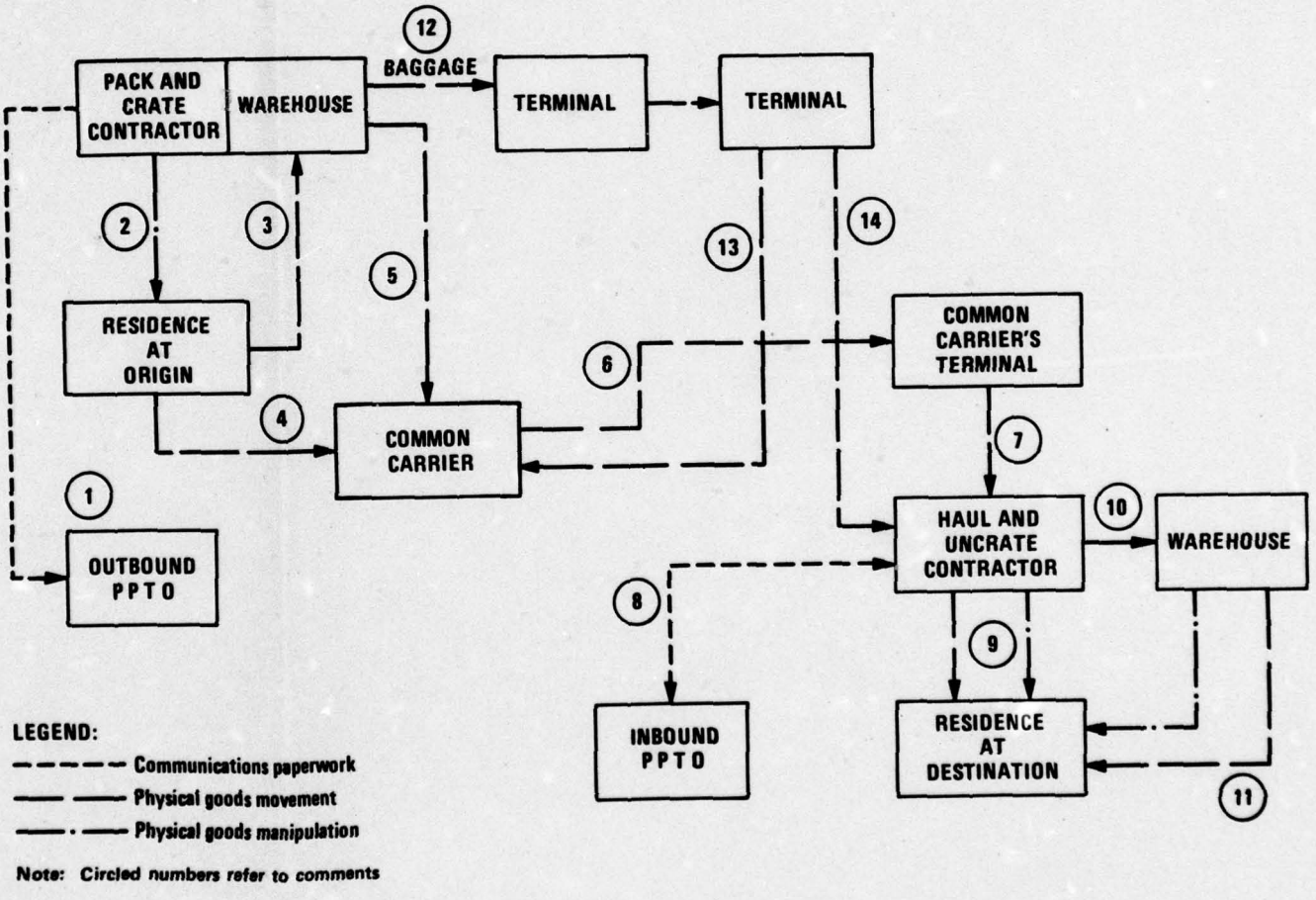


Figure A4 - DPM Mode For Domestic Movement

PERSONAL PROPERTY INFORMATION FLOW
FOR INTERNATIONAL MOVEMENT
COMMENTS ON FIGURE A5

1. An international move is similar to a domestic move with regard to member-interviewer-office interaction and telephone contact with the various contractors and carriers.

2. The nontemporary storage option is executed in exactly the same way as for a domestic move.

3. International shipment of a POV is also similar to a domestic shipment.

4. On the selected date the moving van (TGBL) or common carrier (DPM) picks up the personal property at the member's residence for transportation to the destination. The movements for TGBL and DPM are shown in Figures 3B and 3C respectively.

5. The personal property is delivered to the destination residence. Refer to Figures 3B and 3C.

6. The member should notify the inbound PPTO of his arrival and delivery address as soon as he has secured a residence.

7. The PPTO is alerted that a shipment is on its way by: (1) The arrival of the outbound documentation; (2) The member's arrival and contact; (3) The carrier's arrival and contact.

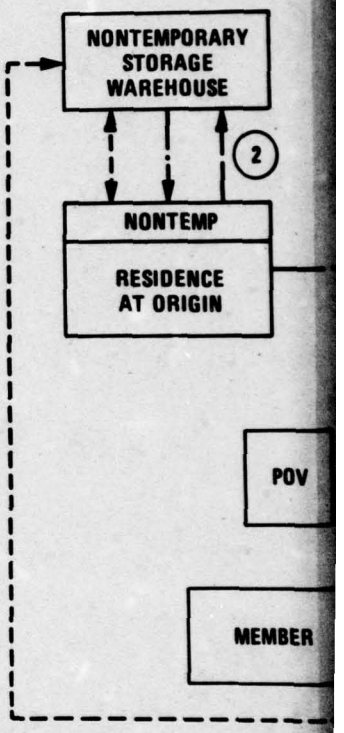


Figure A

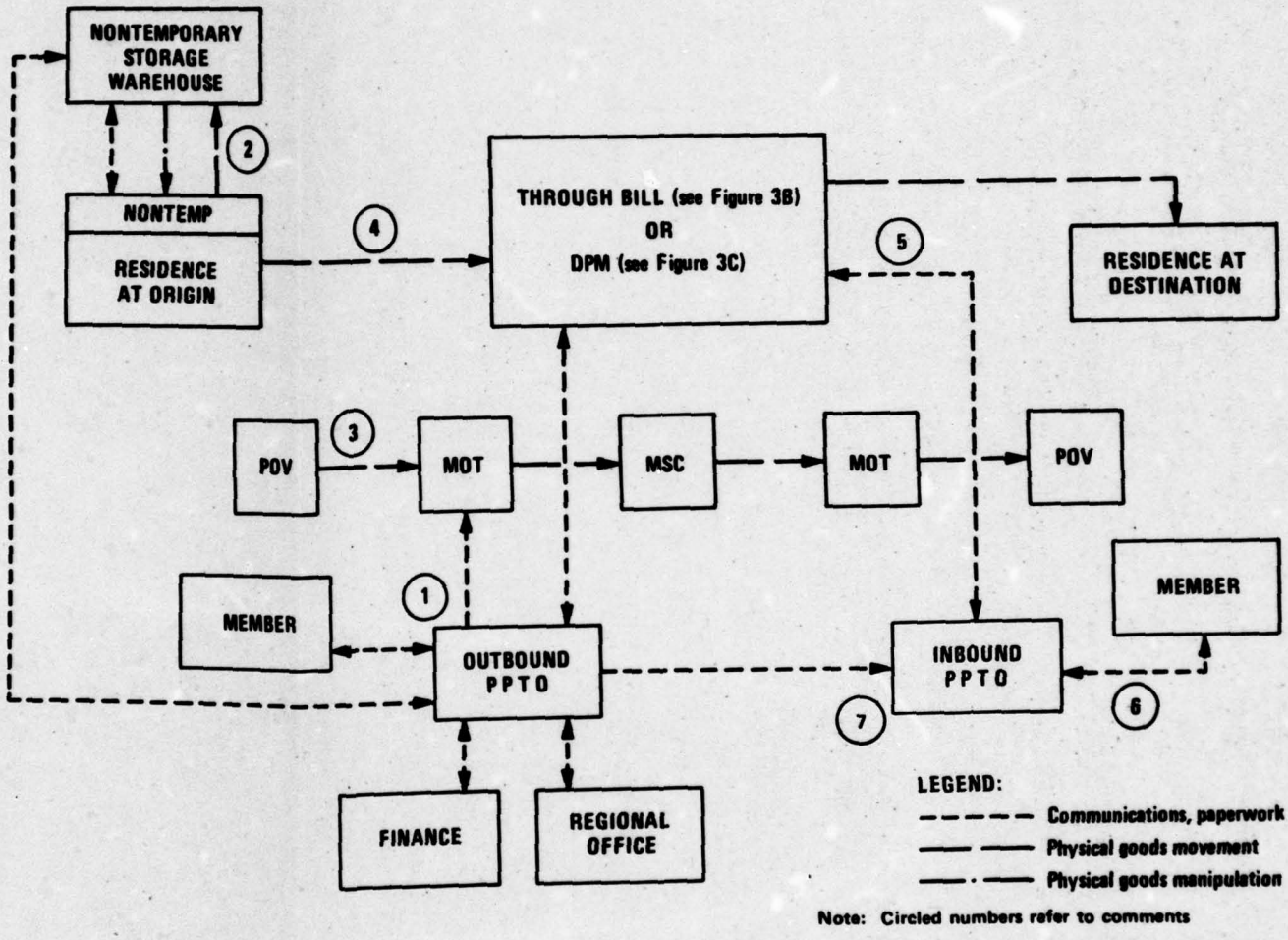


Figure A5 - Personal Property Information Flow For International Movement

THROUGH BILL MODE FOR INTERNATIONAL MOVEMENT
COMMENTS ON FIGURE A6

1. The communications, paperwork, and pick-up date are established for van movement.

2. The personal property is crated and transported by a common carrier (usually a flatbed truck).

RESIDENCE AT ORIGIN

3. The property is delivered to the port of embarkation.

4. At the port of embarkation, the crated personal property is loaded aboard military or commercial transports.

5. The property is then deliverd to the port of debarkation.

6. At the port of debarkation, the shipment is either picked up by the destination agent,

OR

7. The shipment is picked up by a common carrier, AND

8. The shipment is then delivered to the destination agent.

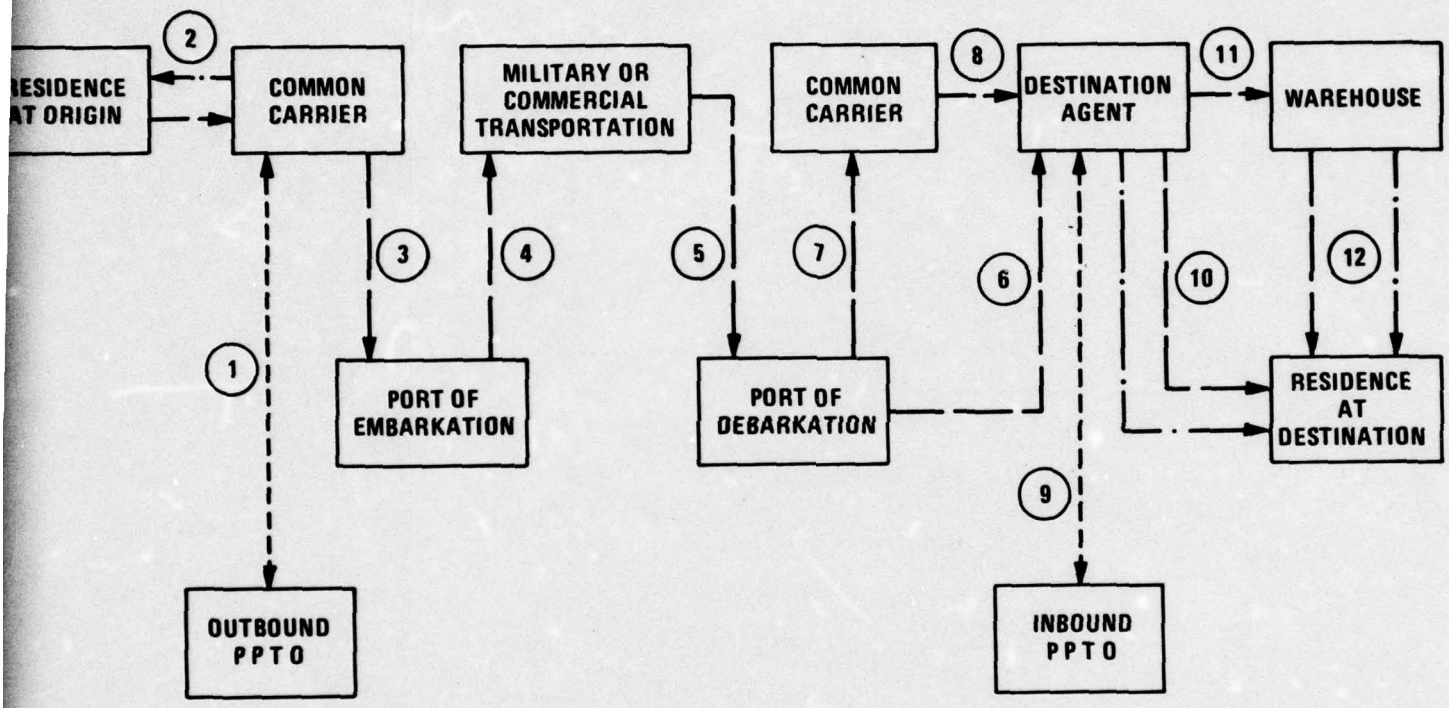
9. The destination agent contacts the inbound PPTO.

10. If the member is available for delivery and his address is known, the property is delivered and uncrated at the destination residence.

11. If the address is not known or the member cannot be contacted, the property is placed in temporary storage.

12. At a later date, the property is delivered and uncrated at the member's residence.

LEGEND:
----- Co
—— —— Pri
——·—— Pri
Note: Circled



EGEND:

- - - - - Communications, paperwork

——— Physical goods movement

——·—— Physical goods manipulation

ote: Circled numbers refer to comments

Figure A6 - Through Bill Mode for International Movement

DPM MODE FOR INTERNATIONAL MOVEMENT
COMMENTS ON FIGURE A7

1. The outbound PPTO established communications, paperwork, and packing and pick-up dates with the various contractors.

2. On the agreed upon pack date, the pack-and-crate contractor arrives at the member's residence to pack his personal property. The property is either left at the residence,

OR

3. The property is moved into the contractor's warehouse.

4. The common carrier picks up the property at the member's residence,

OR

5. The carrier picks up the property at the warehouse.

6. The property is transported to the port of embarkation.

7. The property then moves through the military transportation system to the port of debarkation.

8. At the port of debarkation, the property is picked up by the common carrier and transported to his terminal.

9. The property is then transported to the haul-and-uncrate contractor.

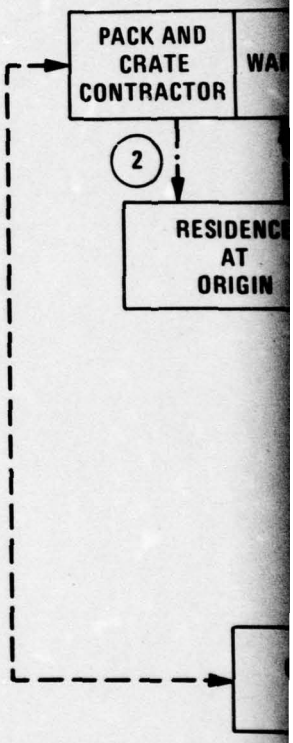
10. The contractor phones the inbound PPTO, who then decides what should be done with the property.

11. The property may be delivered to the member's residence, where it will be unpacked

OR

12. The property may be put in temporary storage at the contractor's warehouse, AND

13. It will be hauled to the member's residence and unpacked at a later date.



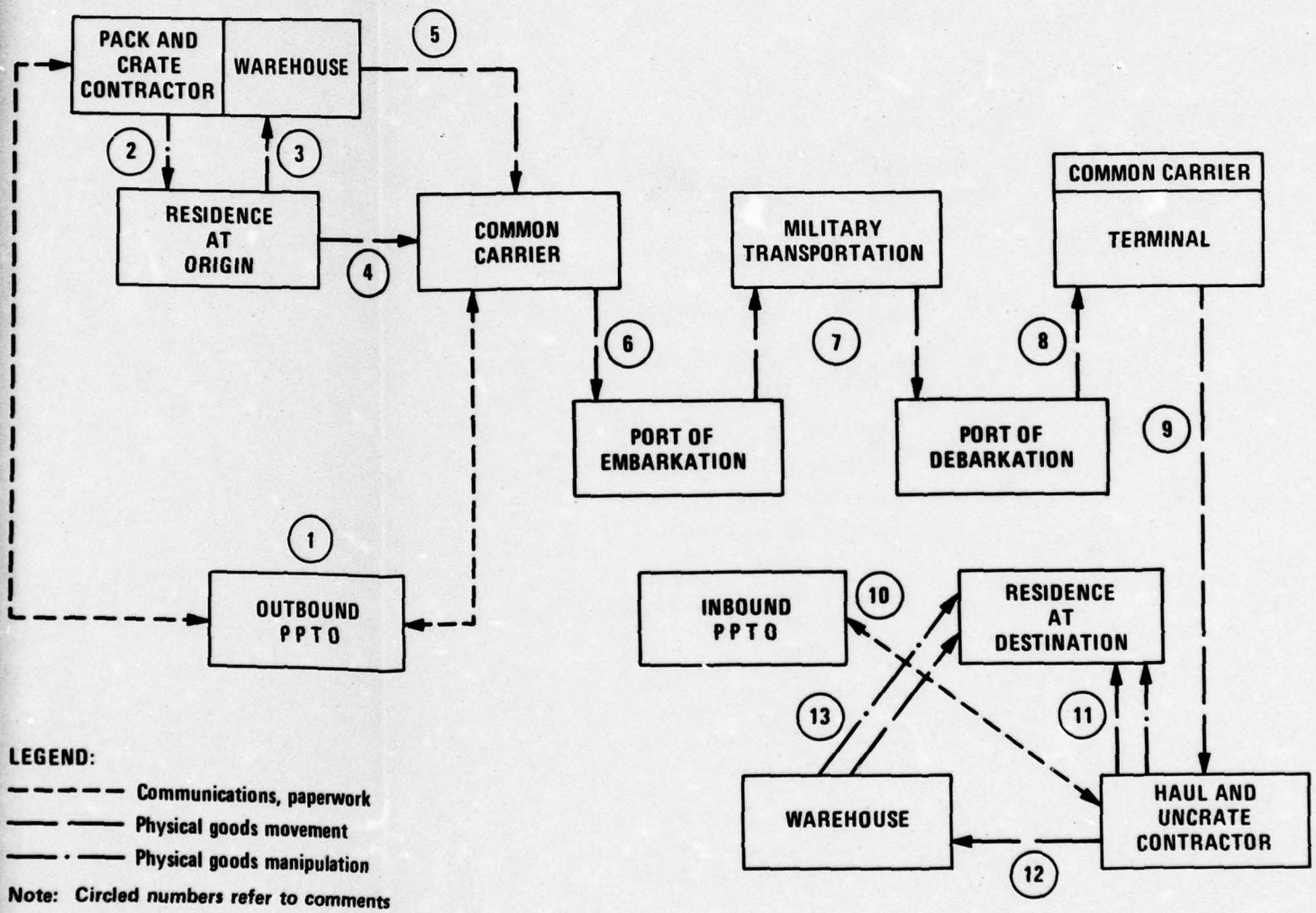


Figure A7 - DPM Mode For International Movement

APPENDIX B
REPRESENTATIVE HARDWARE

More than 25 manufactureres of programmable calculators, intelligent terminals, and dumb terminals were surveyed to identify applicable hardware. System A, System B, System C, System D, and System E terminals were identified as representative hardware. Criteria for selection were: system expandability, programmability, and communications capability. System A is representative of those programmable calculators which meet these criteria. System B equipment was investigated because that manufacturer's hardware "was already available" at the Supply Centers. System C and System D represent the capabilities of intelligent terminals. System C meets the selection criteria best; System D is a system on-hand at the David W. Taylor Naval Ship R&D Center. The System E dumb terminals represent the most efficient, yet cheapest, available video display terminals. An analysis of applicable terminal models for each of the five systems follows.

B.1 SYSTEM A

B.1.1 System Description:

System A is a calculator which can be programmed in the BASIC language. An initial 4096-byte random access user memory, which is expandable to 32,768 bytes, is available. Seven hundred bytes are reserved for system use; the remaining memory is available for user programs. System A has a BASIC language interpreter installed as hardwired, read-only memory (ROM).

A Cathode Ray Tube (CRT) video display, keyboard, and single tape cassette station can be purchased as a package and used with the CPU. The keyboard includes 32 program-entry keys for use as programmer-defined, operator-executed program entry points; it also provides optional single-stroke BASIC commands.

Auxiliary storage can be provided by either additional tape cassette units, a removable flexible disk, a fixed/removable disk, a nine-track tape unit, or punched paper tape. Up to four terminals can multiplex one disk. An 80-column card reader is also available.

A communications coupler provides asynchronous telecommunications capability at transmission rates which vary from 110 to 1200 baud, or 9 to 171 bytes (characters)/second.

Printed output is provided by either a modified IBM Selectric typewriter, an 80-column printer, or a medium or high speed 132-column printer. System A's features are summarized in Table B1. Hardware costs are shown in Table B2.

B.1.2 Advantages:

System A offers a great degree of flexibility in system performance and output capability. Memory in System A is expandable in 4K or 8K blocks, up to 32K. Programming is in BASIC, a high level, easily learned programming language. Output via telecommunications or nine-track tape offers a flexible prototype system design, as does the mass storage feature.

B.1.3 Disadvantages:

Storage of literal strings requires one byte per character; a full-precision number (13 digits) requires nine bytes. Each instruction number requires five bytes, and each variable name requires five bytes. These requirements rapidly exhaust available central memory. Normally System A cannot multiplex output devices; however, up to four terminals can multiplex one disk.

B.2 SYSTEM B

B.2.1 System Description:

Two models of System B were studied; both provide guaranteed B3500 compatible systems. Model 1 is designed as a business management system, and is programmable in COBOL. The COBOL interpreter exists in 12K bytes of "firmware", or read-only memory. The user is initially provided with 4K bytes of usable random access memory. Model 2 is similar to Model 1, but includes a disk as auxilliary storage. The basic work station for each includes a typewriter keyboard, 24 program keys, 4 operation control keys (used to signal termination of input), and a 20-character/second

TABLE B1 - SYSTEM A FEATURES

Functional Element	Characteristics
Keyboard	Standard teletype keyboard BASIC words & many mathematical features entered with single keystroke
Video Display	1024 characters (16 lines of 64 characters)
Processor	32 Special function entry points, 8 bits/byte; 1 alphanumeric character/byte; one 13-digit number/9-bytes
Memory	Random access memory (RAM) Hardwired read-only memory (ROM) BASIC language interpreter
Storage	
Cassette	78,300 Bytes/Cassette
Tape	9-track IBM Compatible (also Burroughs)
Flexible Disk	524K or 786K bytes compatible
Fixed/Removable Disk	1.2M, 2.5M, 5M, or 10M bytes
Communications Adapter	Asynchronous Telephone lines or direct connect 110 to 1200 baud, or from 9 to 171 characters/second
Paper Tape Punch/Reader	300 characters/second
Card Reader	300 cards/minute
Printers	
Low Speed	Modified IBM Selectric typewriter, 20 characters/second
Medium Speed	100 characters/second, 80 Columns 150 characters/second, 132 Columns
High Speed	300 characters/second, 132 Columns
Software	
Assembly Language	None
Higher Level	BASIC
Forms Generation	None
Expansion Capabilities	
Memory	4K basic, expandable in units of 4K or 8K bytes
Language	Additional ROM's available to enhance telecommunications, matrix operations, etc.
Multiplexing	Up to four terminals can share one disk

TABLE B2 - SYSTEM A HARDWARE COSTS

Units	Monthly Rental[1,4]	Purchase[1,2]
CPU, CRT, and Keyboard	$229	$ 5,952
Single Cassette Drive	81	2,112
Dual Cassette Drive	93	2,421
4096 Additional Bytes of Storage	44	1,152
8192 Additional Bytes of Storage	74	1,920
Fixed/Removable Disk Drive		
1.2M	416	10,800
2.5M	443	11,520
5.0M	462	12,000
10.0M	517	13,440
Flexible Disk		
262K	143	3,725
524K	166	4,320
786K	222	5,760
Printers		
20 cps	87	2,304
80-columns, 100 cps	118	3,072
132-columns, 150 cps	245	6,371
132-columns, 300 cps	259	6,720
80-column Card Reader	166	4,320
Nine-track Tape Drive	443	11,520
Telecommunications Controller	33[3]	864[3]

[1] 0.5% discount available if the total purchase price is greater than $24,125.

[2] Maintenance is additional 5% per year after first year's (maintenance included in rental).

[3] Plus line costs.

[4] Based on three-year rental rate, no advance payments, maintenance included; Five-year lease--five advance payments approximately 2/3 rate listed.

Note: first-year lease approximately 1% cheaper, since maintenance is included.

ball printer. A keyboard entry buffer allows overlap between the operator input process and other processing function. A split platen allows two separate forms to be printed independently, with at most three forms mounted simultaneously. The intelligent processor can be purchased separately. System B characteristics are presented in Table B3.

Normally a video display is not part of either system; however, three models of terminal display units can be connected. Screen size varies from 256 characters to 1920 characters. Up to five terminal display units can share one system at a time.

Auxiliary storage is available only on cassette or nine-track tape units on Model 1. Disk storage is available on Model 3. Up to eight processors can share a single nine-track tape unit.

Printed output is provided by the 20-cps printer which comes as part of the work station. Additional lines printers can be connected which have a capability of up to 160 line per minute.

Auxiliary input/output can be provided by a paper tape punch/reader, or by an eighty-column card reader/punch.

Hardware costs are shown in Table B4.

B.2.2 Advantages:

System B is capable of clustering up to five video display units. Up to eight console units can share a single nine-track tape unit. Both Model 1 and Model 2 are programmable in both assembly language and COBOL. Twenty-four program keys and four operation control keys allow programmable hardware interrupts. Buffering allows overlap between operator input and other processing functions. The split platen allows independent printing of two forms, or three forms if two are printed together.

B.2.3 Disadvantages:

Although programmable in COBOL with a 12K "firmware" assembler, System B COBOL must be compiled on a medium-scale computer. Both systems come with a typewriter keyboard and a 20-cps printer as standard equipment. The system can be purchased piecemeal, but the manufacturer greatly prefers to provide preconfigured software.

TABLE B3 - SYSTEM B FEATURES

Functional Element	Characteristics
Keyboard	Standard typewriter alphanumeric 24 Program keys, 4 operation control keys
Video Display	256 Characters (32 x 8) 960 Characters (80 x 12) 1920 Characters (80 x 24)
Processor	Buffered to allow overlap between operator input and other processing functions 8 Bits/byte, 2 Bytes/word, 1 character/byte
Memory	Random access memory Hardwired read only memory (Firmware) COBOL assembler
Storage	
Cassette	Up to 4/processor
Tape	9 track, 800 bpi IBM compatible
Disk Cartridge	2.3M or 4.6M byte (Model 2 only)
Communications Adapter	Asynchronous, 75-1800 baud
Paper Tape Punch/Reader	40 characters/second
Card Reader	200 cards/minute
Printers:	
Low speed	20-30 cps; Printer can hold 2-3 forms at the same time
Medium speed	85 lpm, 132 Columns
High speed	160 lpm, 132 Columns
Software	
Assembly Language	Yes
High Level	COBOL
Forms Generation	None
Expansion capability	
Memory	4K basic RAM, expandable to 48K bytes
Multiplexing	Up to 8 processors may share a tape Up to 4-5 CRT's may share one processor

TABLE B4 - SYSTEM B HARDWARE COSTS

Unit	Monthly Rental		Purchase		Annual Maintenance[3]	
	Model 1	Model 2	Model 1	Model 2[2]	Model 1	Model 2
Model 1, 26" Front feed forms Handler	$455		$13,491		$ 688	
Model 2, I/D Base, 32,768 bytes		$651		$22,050		$ 960
Intelligent Processor						
No cassette	243		7,200		432	
Includes cassette	304		8,820		540	
Video Display						
256 character	80	80	2,723	2,723	84	84
960 character	96	96	3,519	3,519	216	216
1920 character	112	112	4,019	4,019	240	240
Keyboard	14	14	477	477	24	24
Communications interface	7	7	194	194	84	84
Poll & select procedure	12	12	320	320	12	12
2K Memory Extension (up to 16 KB)	31		990		25	
Cassette Tape Subsystem (with controller)	55	79	1,746	2,466	85	108
80-Column Card Reader (with controller)	134	100	3,411	3,186	309	312
80-Column Card Reader/Punch (with controller)	336	305	10,791	10,656	1,115	1,020
Line Printer[1]						
85 lpm (with controller)	282	256	9,000	8,213	788	780
165 lpm (with controller)	302	316	11,430	11,520	963	900
250 lpm (with controller)	417	411	14,850	14,940	1,277	1,188
9-Track Magnetic Tape Unit	393	245	11,250	8,865	537	612
Disk - Dual Cartridge						
2.3M Bytes		364		11,408		804
4.6M Bytes		384		14,513		804
9.2M Bytes		518		20,520		1,032

[1] 20-cps printer comes with unit work station.

[2] Model 2 systems are cheaper in preconfigured package (e.g., processor, 32KB main memory, 26" console, 4.6MB disk drive, and 85 lpm printer for $30,510 purchase or $858 monthly rental).

[3] No maintenance charge for first 90 days after purchase.

B.3 SYSTEM C

B.3.1 System Description:

There are three applicable intelligent terminal-processors available in System C. Each offers a 960-character video display, a standard typewriter keyboard with 41 keys (96 ASCII plus additional characters), and fully programmable memory. Model 1 uses either cassette (125K chars/side) or diskette (up to 4 drives, 250 chars/drive) for auxiliary storage, with an internal memory expansion capability of from 4K to 8K. Both Model 2 and Model 3 processors use cassette, diskette, disk, and/or 7 and 9 track tapes. Model 2 is expandable from 4K to 16K; Model 3 has 24K to 48K central memory expansion capability.

Program may be written in assembly language, BASIC, and an assortment of other higher level languages. Most of the software support, however, is in nonstandard languages. Program support software is included. Forms generation and completion is accomplished by the use of a software package. Model 2 and Model 3 are also capable of being used as the central processor in a timesharing environment.

Both asynchronous and synchronous communication adaptors are available. The asynchronous adaptor is capable of data transmission rates of up to 9600 baud. A 202 type modem is available as an option. The synchronous adaptor operates at a data rate determined by the particular modem used.

Printed output is provided by low, medium, and high speed printers. A 300 card/minute card reader is available as an optional input medium.

The various elements and related information are presented in Table B5. Table B6 provides a detailed presentation of cost data. The mix of processor models, peripherals, and software is displayed in Table B7.

B.3.2 Advantages:

The three processors are highly flexible and allow for many different system configurations. The software includes many higher level languages in addition to assembly language. Forms generation and completion is easily accomplished. Numerous peripherals are available including various storage devices, printers, and communications hardware.

TABLE B5 - SYSTEM C FEATURES

Functional Element	Characteristics
Keyboard	Standard typewriter keys plus numeric and control keys
Video Display	960 characters (80 x 12)
Processor	8 bits = 1 byte = 1 word
Memory	Fully programmable
Storage:	
Cassette	120,000 Bytes/Side
Tape	9-channel, 800 and 1600 bpi 7-channel, 800 and 556 bpi Asynchronous transfer
Flexible disk	256,256 Bytes/Diskette
Cartridge disk	2,400,000 Bytes/Cartridge expandable to 4 disks
Mass storage	20 Surface, removable pack
Communications Adapter	
Asynchronous	Modem option, 37.5-9600 baud
Synchronous	Rate determined by modem used
Card Reader	300 cards/minute
Printers	
Low speed	30 cps, 132 columns
Medium speed	60 lpm, 165 cps, 132 columns
High speed	125 lpm, 330 cps, 132 columns 300 lpm, 132 columns
Software	
Assembly	With support programs
Higher-level	BASIC, RPG 11, SCRIBE
Forms generation	Yes
Timesharing	Yes
Emulation	CDC 200, IBM 2780, UNIVAC DCT-2000
Utility	Sort/Merge, etc.
Multiplexing	
Model 1	None
Model 2	Up to 8 terminals
Model 3	Up to 16 terminals

TABLE B6 - SYSTEM C HARDWARE COSTS

Unit	Purchase*	Maint.	Rental		Installation
			1 YR	3 YRS	
Model 1, 4K	$ 4,530-6,840	$35	$218	$173	$80
Model 1, 8K	5,320-7,638	35	250	197	80
Model 1, 1 Diskette	7,081-12,236	40	273	224	110
Model 2, 4K	6,857-8,142	44	284	234	80
Add'l 4K	1,200-1,425		48	45	
Model 3, 24K	18,000-21,375	80	732	609	200
Diskette	3,133-3,610	25	120	102	50
Dual Diskette Add'l	989-1,140	40	163	140	40
Single Cartridge Disk	7,140-8,075	35	280	249	120
Dual Disk	10,836-12,255	52	424	376	120
Disk Controller	8,232-9,310	60	342	306	120
60 lpm Printer	5,738-6,610	50	282	253	150
125 lpm Printer	7,180-8,273	50	308	275	150
30 cps Printer	4,477-5,985	35	191	171	120
Async Comm Adapt	1,140-1,425	11	61	50	15
Sync Comm Adapt	728-865	11	39	32	15
Card Reader	3,638-4,750	35	160	144	60
Dumb Terminal	1,560-1,853	10	924	768	20

*Lower purchase price reflects quantity discount for purchase of 50 terminals or more.

TABLE B7 - SYSTEM C PROCESSOR/PERIPHERAL COMBINATIONS

	Processor		
	Model 1	Model 2	Model 3
Storage:			
Cassette	X	X	X
Diskette	X	X	X
Cartridge Disk		X	X
Mass Storage Disk		X	X
7 & 9 Track Tape		X	X
Minimum Memory	4K	4K	24K
Maximum Memory	8K	16K	48K
Software			
Form Generation	X(8K only)	X(8K Min)	X
Assembly	X	X	X
RPG	X(w/Diskette)	X	X
Basic	X(w/Diskette)	X	X
Timesharing		X	X
Note: Card reader and printers can be used with any processor.			

B.3.3 Disadvantages:

There are no significant readily discernible disadvantages to System C; however, programmability of System C terminals was not tested. B.4

SYSTEM D

B.4.1 System Description:

The System D information processor contains, as integral components, a 1440-character video display, a 96 character keyboard, up to three tape cassette drives with storage capacity of 156,600 bytes/cassette, and a programmable data processor.

The processor offers random access memory (RAM), microprogram, and read-only memory (ROM) and is expandable from 16K to 32K.

Programs are written in assembly language (a subset of IBM 360 BAL). They are entered via the keyboard and displayed on the CRT. Programming is facilitated through the use of edit, debug, and additional support utility software.

Forms generation and completion are easily accomplished by using a data entry generation package. Upon completion of a form, data are transferred to an appropriate storage device. An ASR model 33-35 teletype simulator program is available to facilitate data transmission and/or to enable the information processor to be used as a remote terminal.

Both asynchronous and synchronous communication adaptors are available. The asychronous adaptor operates at speeds of 110 to 4800 bits per second. An autodial feature and internal Bell 202 equivalent modem are available as options. The synchronous communications adapter operates at 2000, 2400, or 4800 bits per second over normal dial-up or leased lines.

In addition to the cassette drives, optional auxiliary storage can be provided by 7-track and 9-track tapes. A floppy disk capable of storing 250,000 characters has recently been added.

Printed output is provided by low, medium, and high speed printers in 80-column and 132-column format.

A 400-card/minute card reader is available. A card punch is also available.

TABLE B8 - SYSTEM D FEATURES

Functional Element	Characteristics
Keyboard	Teletype ASR II 33 Set 10-Key numeric cluster 8 function keys
Video Display	1600 Characters (20 lines of 80 characters)
Processor	8 Bits/1 Byte/1 Word 1 Character/Byte
Memory	Random Access (RAM) Microprogram Read-only (ROM) 1.2 Microsecond cycle time
Storage:	
Cassette	156,600 Bytes/Cassette
Tape	7 or 9 track, IBM compatible
Flexible Disk	250,000 Bytes/Disk
Card Reader	400 cards/minute
Communications Adapters:	
Asynchronous	110-4800 baud with AUTODIAL and INTEGRAL 202 MODEM options
Synchronous	2000-4800 baud over DIAL-UP or leased lines
Printers:	
Low Speed	15 or 30 characters/second, 80 or 132 columns
Medium Speed	100 or 165 characters/second, 80 or 132 columns
High Speed	125 Lines/Minute, 132 columns
Software:	
Assembly Language	56 instructions
Support	Edit, Debug, Sort/Merge, Subroutine Lib, etc.
Forms Generation	Yes
Terminal Simulation	TTY ASR 33 and various IBM terminals
Expansion Capabilities	
Memory	16K Basic, expandable to 32K

TABLE B9 - SYSTEM D HARDWARE COSTS

Unit	Monthly Rental	Purchase	Maint.	One Time Installation
16K Sys w/3 CASS	$370 w/Maint.	$14,900	$80	$250
16K Sys w/Dual Floppy Disks	555 w/Maint.	17,500	80	195
Additional Floppy Drives		1,500		
30 cps Printer	290 w/Maint.	5,848		150
45 cps Printer	340 w/Maint.	6,848		150
165 cps Printer	418 w/Maint.	8,004		200
9-Track Tape 800 BPI 7" reel	268	5,363	35	120
9-Track Tape 800 BPI 10" reel	360	7,191	35	120
7-Track Tape 800 BPI 7" reel	275	5,500	35	120
7-Track Tape 800 BPI 10" reel	360	7,375	35	120
Async Comm Adapter	29	969	10	15
Autodial	3	98	NC	15
202 Equiv Modem	26	516	3	15
Sync Comm Adapter	60	1,511	30	40
Acoust. Coupler & Cable	30	678	10	10
Card Punch	190	3,300	30	45

These various elements and related data are presented in Table B8 and cost information is detailed in Table B9.

B.4.2 Advantages:

The System D programmable memory can be expanded from 16K to 32K. Form formats can be programmed quickly and simply by use of the form generation package. The ASR 33-35 package simplifies data transmission.

B.4.3 Disadvantages:

No higher language is available, although a BASIC compiler is under development. Disk storage (non-floppy) is not available. The system cannot be clustered or timeshared.

B.5 SYSTEM E

B.5.1 System Description:

The System E terminals represent three classes of dumb video display terminals. Model 1 is simply a video display replacement for a teletype. Model 2 is similar to Model 1, but has a larger screen and a connection for a terminal printer. Model 3 has a slightly larger screen than Model 2, a buffered random access memory, editing capability, two-level video intensity, and connections for a dual tape cassette unit and for either a thermal or impact printer. A summary of characteristics of the three terminals is shown in Table B10.

The dual tape cassette can be used with the Model 3 off-line form completion by storing the "blank form" format as protected data on one cassette and the operator-entered data on the second cassette. Background and foreground data can be displayed at different intensities. The random access memory allows editing of a full screen of data prior to storage on the cassette. The cursor can be positioned by either tabulating or by keystroke spacing.

Hardware costs are presented in Table B11.

B.5.2 Advantages:

Model 3 provides economical off-line forms completion, with diminished intensity for protected field descriptors, editing capability,

TABLE B10 - SYSTEM E FEATURES

Functional Element	Characteristics
Keyboard	Standard teletypewriter keyboard
Video Display	
Model 1	960 characters (80 x 12)
Model 2	1920 characters (80 x 24)
Model 3	1998 characters (74 x 27)
Memory	2048 character random access memory
Storage	
Cassette (Model 3 only)	150,000 characters/cassette
Communications Adapter	Acoustic coupler or any EIA RS-232 B/C interface
Printers	
Thermal	30 cps, 80 columns
Impact	30 cps, 118 columns or 120 cps, 120 columns
Multiplexing	Up to 3 Model 3 terminals can share one printer; Up to 6 Model 3 terminals can share one tape cassette

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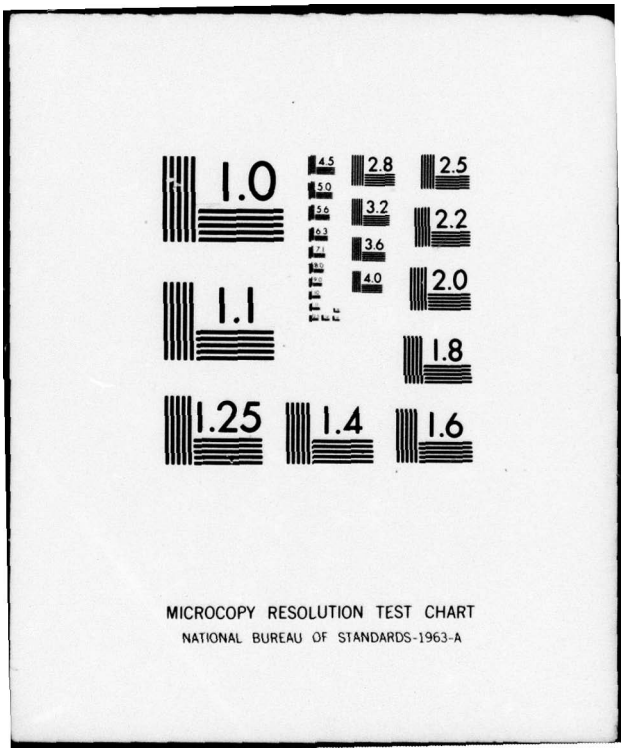
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

TABLE B11 - SYSTEM E HARDWARE COSTS

Unit	Monthly Rental[1]	Purchase	Annual Maintenance
Model 11 Terminal	$ 49	$ 1295	$ 180
Model 12 Terminal	65	1390	180
Model 13 Terminal	98	2400[2]	240
Dual Tape Cassette	89	1590	180
Printers			
Thermal (30 cps, 80 cpl)	83	1900	132
Impact (30 cps, 118 cpl)	128	3100	300
Impact (120 cps, 120 cpl)	150	3750	360
Acoustic Coupler	20	400	--

[1]Rental orders are subject to an installation charge of $50 for the first unit, $20 for the second unit, and $15 for the third and each additional unit installed at the same location.

[2]End of fiscal year sale price of $1600.

and tabulation to data fields. Up to three Model 3 terminals can multiplex one printer, and up to six Model 3 terminals can multiplex one cassette unit.

B.5.3 Disadvantages:

Models 1 and 2 require on-line interaction with a main-frame computer. Line costs for such a configuration may be too expensive, and local ADP managers may not favor on-line usage of their B3500's. The off-line forms formatting on the Model 3 has no means for correcting data on tapes once it is recorded except through a main-frame computer. Both form and data information are written on the cassette. There is no readily available means of transferring "constant data" from one form to another.

APPENDIX C
DATA TRANSMISSION: DIAL-UP VS LEASED LINES

Preliminary estimates were made to determine the maximum number of characters which should be transmitted for a given document. These estimates are shown in Table C1.

If a DD Form 1299 and a GBL are used for outbound shipments, 850 characters are required for transmission (Option 1). For a nontemporary storage transaction the 1299 and the 1164 require a low estimate of 595 characters (Option 2) and a high estimate of 800 characters (Option 3). If all DD Forms 1299 are combined into one transaction record, 455 characters are required for outbound shipments and 305 characters are required for nontemporary storage (Option 4).

The next step is to choose representative installations and determine past workloads. Table 7 indicates the following representative workloads:

ACTIVITY NAME	INBOUND/OUTBOUND	NONTEMP*
NORFOLK	44,711	8942
OAKLAND	38,666	7733
CHARLESTON	17,449	3489
NEW ORLEANS	10,557	2111
INDIANHEAD	1,051	210
HAWTHORNE	280	41

* NONTEMP transactions are estimated at 20% of the Inbound/Outbound totals. (Estimate of 20% is based on Norfolk data.)

TABLE C1 - DOCUMENT TRANSMISSION REQUIREMENTS

DOCUMENT	NUMBER OF CHARACTERS
1299	500
GBL	350
1164*	95 Low
	300 High

INFORMATION RECORD

HEADING	165
FREIGHT	290
NONTEMP	140

* In the case of the 1164, only those fields identified for keypunching were added to determine the low estimate.

Various transmission speeds are available from 110 to 4800 bits/seconds, or from 13 to 600 characters/second. These numbers will be used as lower and upper bounds on transmission rates. The weekly transmission times (in minutes) for the representative PPTOs are shown in Table C2, based upon transmission rates and data options.

It must be remembered that these figures represent only the transmission of raw document data and not input files for central computer processing. However, it is clear from these figures that the transmission time of document data is almost negligible. The worst case is less than three hours a day at the lowest transmission rate and this situation occurs at a location which coincides with a central computer facility. The worst case for an office not having direct access to a supply center computer is less than five hours a week at the lowest transmission rate. At the high rate all transmisSion times are negligible.

The Navy Telecommunications Command reports government rates for leased lines to be $42.50/month for a service terminal (one is needed at each end of the line) plus $.25/mile/month for a 110-baud line and $.50/mile/month for a voice grade (4800 baud) line. A leased line is dedicated for the exclusive use of the lessee, and can be used up to 24 hours a day without additional charge.

Dial-up telephone rates vary by location and are set by the local telephone company. The Chesapeake and Potomac Telephone Company quotes approximate rates for an additional telephone line at $25.00 per month, plus toll charges. Thus, a dial-up line is significantly less expensive for a personal property office with an ADP Center in the local area (such as Norfolk, Oakland, or Charleston, with Burroughs B3500/B3700/B4700 computer systems located at the Supply Centers), since in this case no toll calls would be necessary.

If data are transmitted over long distances when night rates are in effect, the toll charge to any CONUS location is $0.22 per minute. If New Orleans, the largest PPTO not located at a Supply Center, were to transmit its data to Charleston (the closest Supply Center) for processing, the toll costs for transmitting 51 minutes of data (at the lowest transmission rate), for twenty days a month, is $224.40, and therefore the

TABLE C2 - DATA TRANSMISSION TIMES

WEEKLY TRANSMISSION TIME (MINUTES)

ACTIVITY	Options 1 & 2		Options 1 & 3		Option 4	
	TRANSMISSION RATES (CHAR/SEC)		TRANSMISSION RATES (CHAR/SEC)		TRANSMISSION RATES (CHAR/SEC)	
	13	600	13	600	13	600
NORFOLK	1063	23	1105	24	566	12
OAKLAND	926	20	965	21	493	11
CHARLESTON	466	10	486	11	248	5
NEW ORLEANS	255	6	266	6	136	3
INDIANHEAD	25	.5	26	.6	13	.3
HAWTHORNE	5	.1	5	.1	3	.1

total monthly cost is $250. New Orleans is approximately 680 miles from Charleston; therefore, the monthly transmission costs for a low grade leased line would be $170, plus $85 for service terminals, yielding a total monthly cost of $225.

If data are transmitted from New Orleans to Charleston for 51 minutes a day at prime time rates, the toll cost is $0.34 per minute and the total monthly cost is $375. However, the 51-minute transmission period is based on a modem transmission rate of only 110 baud.

If a WATS line is already available to the PPTO, then there are no toll charges for data transmission.

Although a leased line may be cheaper if the worst case is considered, it appears that, in general, there is no requirement to the use of leased lines, and that dial-up lines could be used for data transmission (particularly if a WATS line is available). In fact, since weekly transmission times are so low at some locations, AUTOVON could conceivably be used.

APPENDIX D
PART I
GLOSSARY OF PERSONAL PROPERTY ABBREVIATIONS AND TERMS

APPO	Automated Personal Property Operations
AR	As Required
CERS	Carrier Evaluation and Reporting System. CERS is at present a MTMC experimental method for establishing personal property carrier performance standards, collecting performance data, measuring/grading performance against those standards, and distributing traffic on the basis of historical performance.
CONSOLIDATED SHIPMENT	A personal property shipment which is considered with other shipments destined to a common location and tendered to the commercial carrier as a single shipment under an advantageous tariff rate.
CONUS	Continental United States, consisting of the 48 contiguous states and the District of Columbia.
DOMESTIC SHIPMENT	The movement of household goods or unaccompanied baggage within CONUS by air or surface transportation
DPM	Direct Procurement Method. A method in which the Government manages the shipment throughout.
FMSO	Fleet Material Support Office.
GBL	Government Bill of Lading.
GROUPED SHIPMENT	A personal property shipment tendered to a commercial carrier with other shipments destined to a common area.
HHG	Household goods. Furniture and furnishings or equipment, clothing, baggage, personal effects, professional books, papers, equipment, and all other personal property associated with the home and person.

HIGH VALUE ITEMS	Those articles which are of extraordinary value or which are easily pilferable and for which a substantial illegal market exists. These items are normally packed separately, but travel along with the regualr household goods shipment.
IDA	Integrated Disbursing and Accounting. A disbursing system in which transaction data will be captured and entered into the system only once, with subsequent data transmitted by telecommuications rather than by the creation and distribution of hard copy documents.
IFB	Invitation For Bids. A request to interested parties to submit bids for performance of services or provision of materials according to specifications provided.
IFMS	Integrated Financial Management System. A Navy Project Office established to design, develop, and implement major financial management improvement projects.
ITGBL	International Through Government Bill of Lading. A single GBL issued to a commercial household goods carrier to procure transportation and related services for a shipment of household goods from origin to destination between CONUS and an overseas point, between one theater and another theater, or between locations within a theater.
ITO	Installation Transportation Officer. The individual designated by appropriate authority to perform assigned traffic management functions at installations or activities, regardless of organizational title.
JPPSO	Joint Personal Property Shipping Office. An activity manned jointly by the Services to provide traffic management for the movement and storage of personal property.
LDC	Logistics Data Communication. A FMSO Project to provide direct communication between NSC computers.
M	Monthly
MEMBER	The military or civilian employee for whom services are being provided at government expense.

MOT	Military Ocean Terminal
MSC	Military Sealift Command
MTMC	Military Traffic Management Command. The single manager for military traffic, land transportation, and common user ocean terminals.
NAVMAT	Naval Material Command.
NAVSUP	Naval Supply Systems Command.
NONTEMP	Nontemporary storage.
NONTEMPORARY STORAGE	Storage which is authorized in a government or commercial warehouse and is generally of a long term nature.
NOTEMPS	Air Force computer system for handling nontemporary storage of household goods accounts.
NRFC	Naval Regional Finance Center.
NSC	Naval Supply Center.
P&C	Pack and crate.
PERSONAL PROPERTY	Items considered to be household goods, which includes furniture and furnishings, or equipment; clothing; unaccompanied baggage; personal effects; professional books, papers, and equipment; and all other property associated with the home and person.
POV	Privately owned motor vehicle. Any self-propelled wheeled motor conveyance that is primarily for use as a passenger carrying vehicle.
PPAIS	Personal Property Automated Information System. A series of computer programs written by the Air Force for implementation at JPPSO, San Antonio.
PPTO	Personal Property Transportation Office, also Personal Property Transportation Officer. (See ITO).
Q	Quarterly.

RDD	Required Delivery Date.
REQUIRED DELIVERY DATE	A specified calendar date (excluding Saturdays, Sundays, and U.S. holidays) on or before which the carrier agrees to offer the entire shipment of personal property for delivery to the member or his agent at destination.
SA	Semi-annually.
SHIPMENT AWARD ROSTER	A listing by rank and category of eligible carriers to a specific destination, which is utilized by the shipment clerk in offering personal property shipment.
SIT	Storage-in-Transit. Storage in connection with the shipment of personal property. Such storage is cumulative and may accrue at origin and/or destination to a maximum of 180 days.
TCMD	Transportation Control Movement Document.
TDR	Traffic Distribution Record.
TGBL	Through Government Bill of Lading.
THROUGH GOVERNMENT BILL OF LADING (TGBL)	A single GBL issued to a commercial household goods carrier to procure transportation and related services for a shipment of household goods from origin to destination.
TMO	Transportation Management Officer (See ITO).
TRAFFIC DISTRIBUTION RECORD (TDR)	A continuing record of distribution of traffic among competing origin carriers qualified to serve a destination area.
UADPS	*Uniform Automated Data Processing System.* The Supply Management Program which is administered and directed by NAVSUP, implemented by FMSO, and operated by ashore and afloat components of the Navy.
UNACCOMPANIED BAGGAGE	Those items of a member's personal property which are required by him and his family right up to the moving day and will be needed immediately upon arrival at the member's destination.
W	Weekly.

PART II
GLOSSARY OF AUTOMATED DATA PROCESSING ABBREVIATIONS AND TERMS

ASYNCHRONOUS TRANSMISSION	Transmission in which time intervals between transmitted characters may be of unequal length Transmission is controlled by start and stop elements at the beginning and end of each character. Also called Start-Stop transmission.
BATCH PROCESSING	A method of processing in which a number of similar input items are accumulated and processed together.
BAUD	A unit of signalling speed equal to the number of discrete conditions or signal events per second. In asynchronous transmission, the unit of signalling speed corresponding to one unit of interval per second; that is, if the duration of the unit interval is 20 milliseconds, the signalling speed is 50 BAUD. BAUD is the same as "bits per second" only if each signal event represents exactly one bit.
BINARY DIGIT (BIT)	In binary notation either the character 0 or 1. "Bit" is the commonly used abbreviation for Binary Digit.
BYTE	A binary element string operated upon as a unit and usually shorter than a computer word, e.g., six-bit, eight-bit, or nine-bit bytes.
CATHODE-RAY TUBE (CRT)	A television-like picture tube used in visual display terminals.
CENTRALIZED (COMPUTER) NETWORK	A computer network configuration in which a central node provides computing power, control, or other services. Compare: Decentralized Network.
CENTRAL PROCESSING UNIT	A unit of a computer that includes the circuits controlling the interpretation and execution of instructions. Synonymous with main frame. Abbreviated CPU.
CLUSTERING	The ability of several terminals to share a single processor or controller. Clusters may be located at the computer site, attached directly to a processor or peripheral, or they may be at remote sites and talk to the CPU through a communications box.

COMPUTER NETWORK	An interconnection of assemblies of computer system, terminals, and communications facilities.
CONVERSATIONAL	Pertaining to a mode of processing that involves step-by-step interaction between the user at a terminal by means of keyboard and display and a computer. See also: Interactive.
DATA BASE	1) The entire collection of information available to a computer system. 2) A structured collection of information as an entity or of related files treated as an entity.
DATA COLLECTION	The act of bringing data from one or more points to a central point.
DATA COMMUNICATION	The interchange of data messages from one point to another over communications channels. See also: Data Transmission.
DATA PHONE	A trademark as well as a service mark of the AT&T Company. As a trademark, it identifies the transmission of data over the regular telephone network.
DATA SET	1) A modem. 2) A collection of data records, with a logical relation of one to another. See also: Data Phone, Modem.
DATA TRANSMISSION	The sending of data from one place for reception elsewhere. Compare: Data Communication.
DECENTRALIZED (COMPUTER) NETWORK	A computer network, in which some of the network control functions are distributed over several network nodes. Compare: Centralized Network.
DIAL-UP	The use of a dial or push-button telephone to initiate a station-to-station telephone call.
DUMB TERMINAL	A terminal without a user-programmable processor but usually including a minimum editing capability, CRT display, keyboard, and optional peripherals.
HARD COPY	A printed copy of machine output in readable form; for example, reports, listings, documents, summaries.
HARDWARE	Physical equipment, as opposed to a computer program or method of use, e.g., mechanical, electrical, magnetic, or electronic devices.

INFORMATION	The organizational content of a signal.
INFORMATION RETRIEVAL	That branch of computer technology concerned with techniques for storing and searching large quantities of data and making selected data available. An information retrieval system may not be a real-time system.
INPUT	a. The data to be processed. b. The state or sequence of states occurring on a specified input channel. c. The device or collective set of devices used for bringing data into another device. d. A channel for impressing a state on a device or logic element. e. The process of transferring data from an external storage to an internal storage.
INTELLIGENT TERMINAL	A terminal with a user-programmable processor normally including CRT display, keyboard, and optional peripherals.
INTERACTIVE	Pertaining to exchange of information and control between a user and a computer process, or between computer processes. See also: Conversational.
INTERFACE	1) A shared boundary defined by common physical interconnection characteristics, signal characteristics, and meanings of interchanged signals. 2) A shared logical boundary between two software components.
LEASED LINE	A line reserved for the exclusive use of a leasing customer without interexchange switching arrangements. Also called Private Line.
MINI-COMPUTER	Generally a small, general-purpose digital computer with a central processor and core memory (approximately 4096 words). It has a small word-size, 12 bits or less, and is economically priced. Mostly used in the on-line, real-time environment. Current machines vary in word lengths, input/output facilities, instruction sets, software, and performance.
MODEM	Modulator-Demodulator. A device that modulates signals transmitted over communications circuits. Syn: Data set.

MULTIPLEXING	The division of a transmission facility into two or more channels.
OFF-LINE	Pertaining to equipment or devices not under direct control of the central processing unit. May also be used to describe terminal equipment not connected to a transmission line.
ON-LINE	1) Pertaining to equipment or devices under control of the central processing unit. 2) Pertaining to a user's ability to interact with a computer.
OUTPUT	a. Data that have been processed. b. The state or sequence of states occurring on a specified output channel. c. The device or collective set of devices used for taking data out of a device. d. A channel for expressing a state of a device or logic element. e. The process of transferring data from an internal storage to an external storage device.
POLLING	The process of inviting another station or node to transmit data.
PRIVATE LINE or PRIVATE WIRE	A channel or circuit furnished a subscriber for his exclusive use.
RANDOM ACCESS	Pertaining to a storage device in which the access time of data or blocks of data is effectively independent of the location of the data (e.g., disk).
REAL TIME	a. Pertaining to the actual time during which a physical process takes place. b. Pertaining to the performance of a computation during the actual time that the related physical process takes place, in order that results of the computations can be used in guiding the physical proceedures.
REGIONAL (COMPUTER) NETWORK	1) A computer network whose nodes provide access for users in a defined geographical area. 2) A network whose nodes provide access for a specified class of users.

SOFTWARE	A set of computer programs, procedures, rules, and associated documentation concerned with the operation of network computers, e.g., compilers, monitors, editors, utility programs. Compare: Hardware.
STORAGE	A general term for any device capable of retaining information.
SYNCHRONOUS TRANSMISSION	Transmission in which the data characters and bits are transmitted at a fixed rate with the transmitter and receiver synchronized. This eliminates the need for start-stop elements, thus providing greater efficiency. Compare: Asynchronous Transmission.
TELECOMMUNICATIONS	Pertaining to the transmission of signals over long distances, such as by telegraph, radio, or television.
TERMINAL	A device or computer which may be connected to a local or remote host system, and for which the host system provides computational and data access services. Two common types of terminals are timesharing (typically interactive keyboard terminals) and remote batch.
TIME-SHARING	A method of operation in which a computer facility is shared by several users for different purposes at (apparently) the same time. Although the computer actually services each user in sequence, the high speed of the computer makes it appear that the users are all handled simultaneously.
WIDE AREA TELEPHONE SERVICE	A service provided by telephone companies that permits a customer, by use of an access line, to make calls to telephones in a specific zone on a dial basis for a flat monthly charge.
WORD	a. In telegraphy, six characters (five characters plus one space). b. In computing, an ordered set of characters that is a normal unit in which information may be stored, transmitted, or operated upon within a computer.

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